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SCHOOLS AND ACADEMIES.

BY W. H. C.

THESE EXTENSIVE ARRANGEMENTS ARE COMBINED  
AND PRESENTED INSTRUCTIVELY,

ON THE SYSTEM OF PESTALOZZI.

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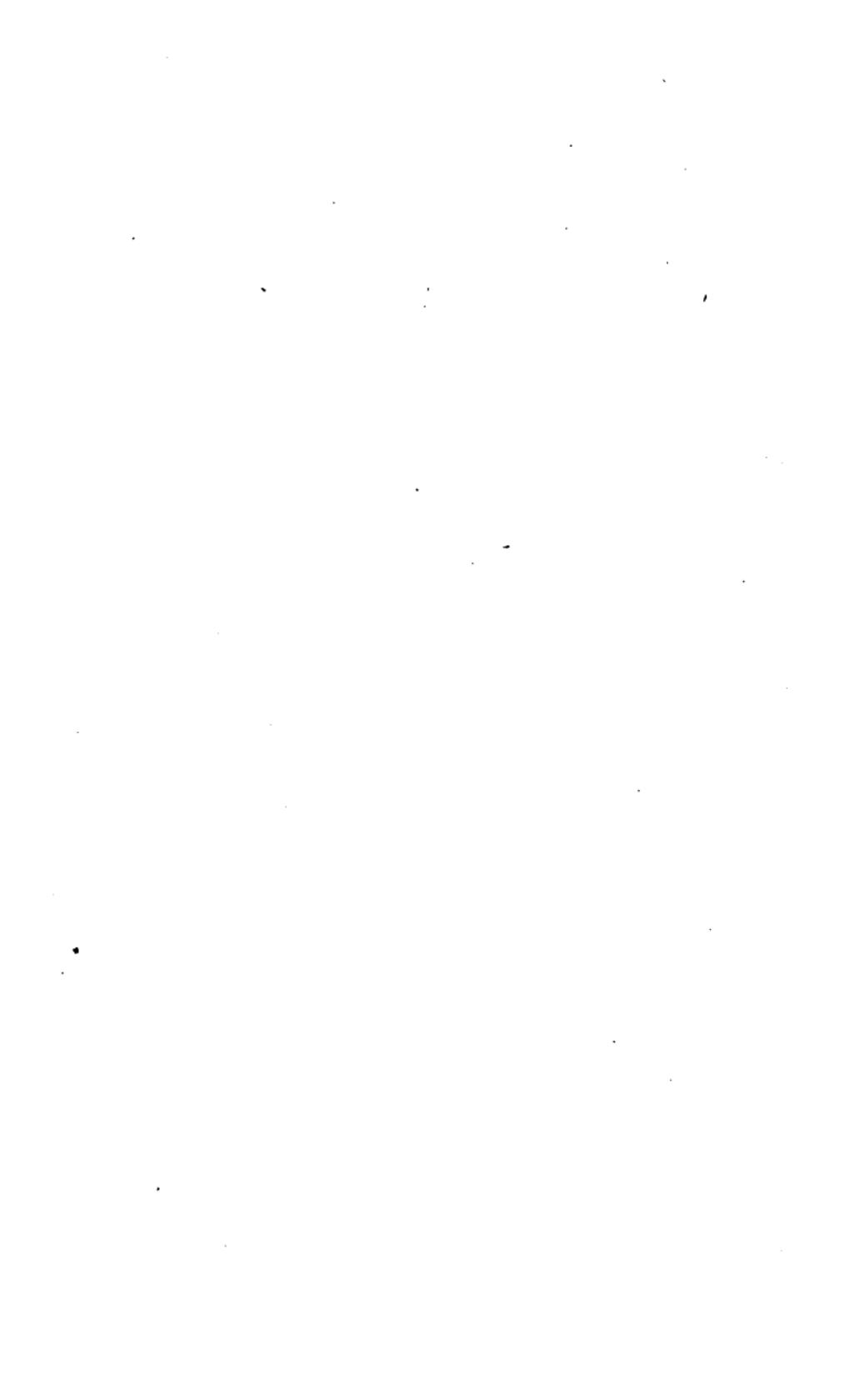


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6

THE  
ELEMENTS OF ARITHMETIC;

FOR

SCHOOLS AND ACADEMIES.

IN WHICH

DECIMAL AND INTEGRAL ARITHMETIC ARE COMBINED,  
AND TAUGHT INDUCTIVELY,

ON THE SYSTEM OF PESTALOZZI.

PART FIRST.

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BY PLINY E. CHASE.

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C PHILADELPHIA:  
URIAH HUNT AND SON.  
1844.

~~Entered Feb. 118. 44. 3~~

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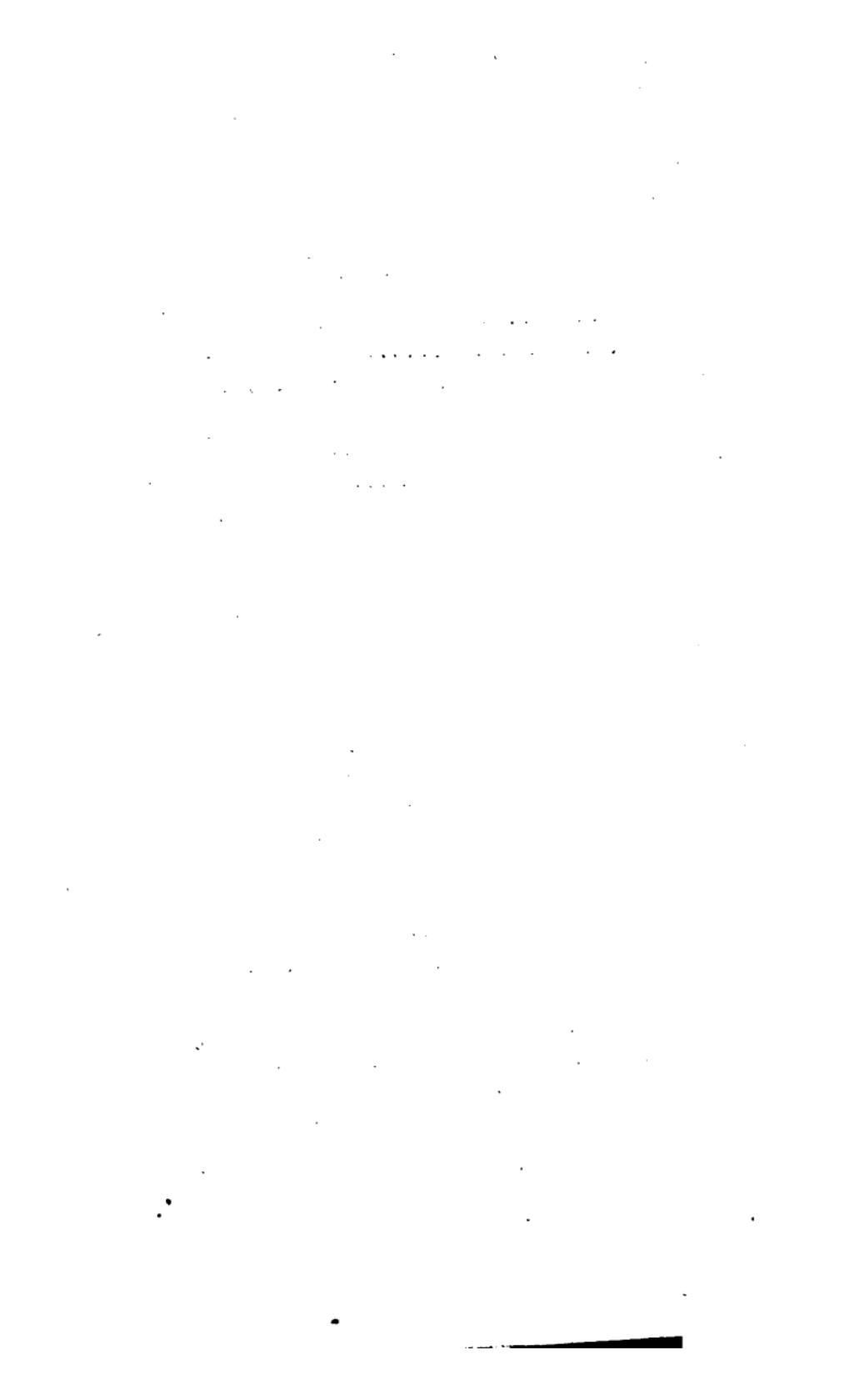
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## PREFACE.

THE following work is the First Part of a treatise on Arithmetic, the plan of which is in many respects entirely new.

The book commences with Mental Questions, designed to illustrate all the fundamental principles of the science, and of such a character as to be understood by children at a very early age. The addition, subtraction, multiplication and division, of units and tens,—the reason for carrying the tens in each operation,—the principles of simple and compound, proper and improper fractions, and the various operations that may be performed upon them, are all taught in the most simple and concise manner.

After the pupil has become accustomed to exercise his judgment in the solution of these questions, he is allowed to read and write numbers embracing many denominations, and to perform examples on the slate. The assistance of the teacher is then required, to explain *clearly* and *fully* on the board, each new principle that is introduced, and with little further aid, the pupil will be able to go through the remaining chapters.

The boy who can read and write integers as high as millions, may be taught, with equal facility, to read and write decimals as low as millionths; and if Numeration be properly inculcated at first, no more difficulty will be found in the operations on decimals, than in those on whole numbers. The two are therefore very properly combined,—the necessity of a separate and unintelligible series of rules, is obviated,—and the scholar learns readily to solve *all* questions that may be proposed to him.

No rules are given to be learned by rote, but the parts that are of most importance are printed in italics. The teacher should assure himself, by frequent questioning, that every principle is fully understood,—the pupil being required to tell not only *how*, but *why*, every thing is done.

The remarks given under the head of *Examples for the Board*, are designed as a guide to the teacher in his explanations to the class. If the scholar be left entirely to himself, he will not understand any assistance the book may give, nearly so well as if it were communicated verbally by his instructor.

The difference between abstract and concrete numbers will be early perceived by the pupil, and it will be well for the teacher to

examine him on that subject, after he has mastered the first few sections. If similar examinations are continued throughout the whole course of the work, the scholar who has properly studied merely the present volume, will be able to solve all questions that occur in ordinary business, readily and *understandingly*.

---

#### HINTS TO THE TEACHER.

The object of the text-book should be merely, to serve as a guide,—to point out the way, and assist the pupil, in removing any obstacles that may obstruct his progress. It is not sufficient, that the reader should have a tolerable understanding of its contents, or that he should be able to repeat by rote all its arbitrary rules; but he should be taught to form his own rules, and to apply the principles which he has himself discovered, in every possible manner. To give this full understanding, the aid of the teacher will be frequently required, and he will be enabled to give his assistance to the best advantage, by adopting a plan similar to the following, from which the author has derived great benefit.

At the end of every lesson, both in the Mental and the Written Exercises, the books are all closed, and original questions are proposed by the teacher, to the class, and by each pupil to his left-hand neighbour. In this manner, the familiarity of each one with the subject of the lesson, is thoroughly tested, and the teacher perceives at once what farther explanation is required.

The class are examined each day, on the preceding lesson, and are required frequently to review the part they have gone over. They are never allowed to enter on a new section, until they are perfectly familiar with the one they have left.

If the pupil finds any question contained in the book, too difficult, he is required to work out the statement with smaller numbers, until he perceives the course to be pursued.

At the recitations in Written Arithmetic, each scholar hands his slate to his neighbour. The proper mode of performing the sums is then stated, the correct answers are read from the key, and the errors marked on each slate, to be afterwards corrected by the owner. After the slates have been thus examined, one or more original questions are written on the board, to be solved and explained aloud, by different members of the class.

PHILADELPHIA, 1844.

THE

## ELEMENTS OF ARITHMETIC.

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### MENTAL ARITHMETIC.

[**THE** teacher should illustrate this and the succeeding sections by grains of corn, beans, or some other small articles. Let him make piles of ten, and show that two piles will be called twenty; three piles, thirty; ten piles, one hundred, and so on. In this way, the pupil will soon learn to count a thousand, without difficulty.]

1.—1. Charles has one apple, and James gives him one more. How many does he then have? How many are one and one?

2. I have two pins, and my sister gives me one more. How many do I then have? How many are two and one?

3. George has three cents, and his father gives him one more. How many has he then? Three and one are how many?

4. How many fingers have you on one hand? How many thumbs? How many of both? Four and one are how many?

5. William has five plums in one hand and one in the other. How many has he in both hands? Five and one are how many?

6. Jane has six peaches, and Eliza has one. How many have they both? Six and one are how many?

7. If I ride seven miles and then walk one mile, how many miles shall I have gone? Seven and one are how many?

8. Eight boys are playing, and one more comes to join them. How many are there then? Eight and one are how many?

9. If I spend nine cents for fruit, and have one cent left, how many cents had I at first? Nine and one are how many?

One, two, three, four, five, &c., are called numbers. Joining numbers together as we have done in the above examples, is called ADDITION, and by continuing to add, we may form numbers to any extent we please.

There are various ways of expressing numbers: by words, as above; by letters, as was the custom among the Romans; or by the ten Arabic figures,

One, Two, Three, Four, Five, Six, Seven, Eight, Nine, Naught,  
1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

10. Write on the board the figures from one to ten. Count ten.

The number ten is written by placing 1 at the left hand of 0, thus, 10. Twenty, or 2 tens, is written 20; Thirty, or 3 tens, 30; and so on to one hundred, or 10 tens, which is written 100.

11. The number one is called a *Unit*. How many units are there in 2? How many in 3? In 5? In 8? In 9? In 10?

II.—1. I have 10 fingers and thumbs. If I had 1 more, how many should I have? How many are 10 and 1?

2. In a certain school 10 boys were studying Latin,

and 2 more were put with them. How many were there then in the class? 10 and 2 are how many?

3. A labourer receives 10 dollars for one week, and 3 dollars for the next. How much does he receive in the whole? 10 and 3 are how many?

4. If a knife costs 10 cents, and a pencil costs 4 cents, how much must I give for both? 10 and 4 are how many?

5. Thomas has 10 marbles, and finds 5 more. How many has he then? 10 and 5 are how many?

6. Lucy has 10 pins, and her mother gives her 6 more. How many does she then have? 10 and 6 are how many?

7. 10 masons and 7 carpenters are building a house. How many workmen are there in the whole? 10 and 7 are how many?

8. In a certain town there are 10 streets running from north to south, and 8 running from east to west. How many are there in the whole? 10 and 8 are how many?

9. A ship sails 10 miles the first hour, and 9 miles the second. How far does she sail in 2 hours? 10 and 9 are how many?

10. John has 10 marks for good behaviour, and 10 for misconduct. How many has he in the whole? 10 and 10 are how many? Two 10s are how many?

11. Edward performed 20 sums without assistance, and 1 with the aid of his teacher. How many were there in the whole? 20 and 1 are how many?

12. There are 20 boys and 7 girls in a school. How many are there of both? 20 and 7 are how many?

13. A farmer has 20 sheep and 9 lambs. How many has he of both? 20 and 9 are how many?

14. John bought 20 plums, and his father gave him

10 more. How many had he in the whole? 20 and 10 are how many? Three times 10 are how many?

The numbers from 10 to 100 are written by placing the units at the right hand of the tens, as in the following table.

Ten,	or 1 ten and 0 units,	10
Eleven,	or 1 ten and 1 unit,	11
Twelve,	or 1 ten and 2 units,	12
Thirteen,	or 1 ten and 3 units,	13
Fourteen,	or 1 ten and 4 units,	14
Fifteen,	or 1 ten and 5 units,	15
Sixteen,	or 1 ten and 6 units,	16
Seventeen,	or 1 ten and 7 units,	17
Eighteen,	or 1 ten and 8 units,	18
Nineteen,	or 1 ten and 9 units,	19
Twenty,	or 2 tens and 0 units,	20
Twenty-one,	or 2 tens and 1 unit,	21
Twenty-two,	or 2 tens and 2 units,	22
Twenty-three,	or 2 tens and 3 units,	23
Twenty-four,	or 2 tens and 4 units,	24
Twenty-five,	or 2 tens and 5 units,	25
Twenty-six,	or 2 tens and 6 units,	26
Twenty-seven,	or 2 tens and 7 units,	27
Twenty-eight,	or 2 tens and 8 units,	28
Twenty-nine,	or 2 tens and 9 units,	29
Thirty,	or 3 tens and 0 units,	30
Thirty-one, &c.,	or 3 tens and 1 unit,	31
Forty,	or 4 tens and 0 units,	40
Forty-one, &c.,	or 4 tens and 1 unit,	41
Fifty,	or 5 tens and 0 units,	50
Sixty,	or 6 tens and 0 units,	60
Seventy,	or 7 tens and 0 units,	70
Eighty,	or 8 tens and 0 units,	80
Ninety,	or 9 tens and 0 units,	90
Ninety-nine,	or 9 tens and 9 units,	99
One hundred,	or 10 tens and 0 units,	100

15. Count one hundred. Write in figures the numbers from one to one hundred.

16. Repeat the Addition Table.

1 and 1 are 2	2 and 1 are 3	3 and 1 are 4
1 and 2 are 3	2 and 2 are 4	3 and 2 are 5
1 and 3 are 4	2 and 3 are 5	3 and 3 are 6
1 and 4 are 5	2 and 4 are 6	3 and 4 are 7
1 and 5 are 6	2 and 5 are 7	3 and 5 are 8
1 and 6 are 7	2 and 6 are 8	3 and 6 are 9
1 and 7 are 8	2 and 7 are 9	3 and 7 are 10
1 and 8 are 9	2 and 8 are 10	3 and 8 are 11
1 and 9 are 10	2 and 9 are 11	3 and 9 are 12
1 and 10 are 11	2 and 10 are 12	3 and 10 are 13

4 and 1 are 5	5 and 1 are 6	6 and 1 are 7
4 and 2 are 6	5 and 2 are 7	6 and 2 are 8
4 and 3 are 7	5 and 3 are 8	6 and 3 are 9
4 and 4 are 8	5 and 4 are 9	6 and 4 are 10
4 and 5 are 9	5 and 5 are 10	6 and 5 are 11
4 and 6 are 10	5 and 6 are 11	6 and 6 are 12
4 and 7 are 11	5 and 7 are 12	6 and 7 are 13
4 and 8 are 12	5 and 8 are 13	6 and 8 are 14
4 and 9 are 13	5 and 9 are 14	6 and 9 are 15
4 and 10 are 14	5 and 10 are 15	6 and 10 are 16

7 and 1 are 8	8 and 1 are 9	9 and 1 are 10
7 and 2 are 9	8 and 2 are 10	9 and 2 are 11
7 and 3 are 10	8 and 3 are 11	9 and 3 are 12
7 and 4 are 11	8 and 4 are 12	9 and 4 are 13
7 and 5 are 12	8 and 5 are 13	9 and 5 are 14
7 and 6 are 13	8 and 6 are 14	9 and 6 are 15
7 and 7 are 14	8 and 7 are 15	9 and 7 are 16
7 and 8 are 15	8 and 8 are 16	9 and 8 are 17
7 and 9 are 16	8 and 9 are 17	9 and 9 are 18
7 and 10 are 17	8 and 10 are 18	9 and 10 are 19

The numbers from one hundred to ten hundred or one thousand, are written by placing the hundreds to the left of the tens. Thus we write—

Two hundred,	or 2 hundreds 0 tens and 0 units, 200
Two hundred and fifty,	or 2 hundreds 5 tens and 0 units, 250
Two hundred and fifty-six,	or 2 hundreds 5 tens and 6 units, 256
Three hundred,	or 3 hundreds 0 tens and 0 units, 300
Eight hundred,	or 8 hundreds 0 tens and 0 units, 800
Nine hundred and seventy-one,	or 9 hundreds 7 tens and 1 unit, 971

III.—1. Samuel had one plum in his right hand and two in his left. How many had he in both hands? How many are 1 and 2? 11 and 2? 21 and 2? 31 and 2? 41 and 2? 51 and 2? 61 and 2? 71 and 2? 81 and 2? 91 and 2?

2. I have two ears and two eyes. How many have I of both? How many are 2 and 2? 12 and 2? 22 and 2? 32 and 2? 42 and 2? 52 and 2? 62 and 2? 72 and 2? 82 and 2? 92 and 2?

3. George and Francis met a poor boy. George gave him three apples, and Francis gave him two. How many apples did the boy receive? How many are 3 and 2? 13 and 2? 23 and 2? 33 and 2? 43 and 2? 53 and 2? 63 and 2? 73 and 2? 83 and 2? 93 and 2?

4. Susan found four pins on the table, and two on the floor. How many did she find? How many are 4 and 2? 14 and 2? 24 and 2? 34 and 2? 44 and 2? 54 and 2? 64 and 2? 74 and 2? 84 and 2? 94 and 2?

5. Mary missed five words in her spelling lesson, and Jane missed two. How many did they both miss? How many are 5 and 2? 15 and 2? 25 and 2? 35 and 2? 45 and 2? 55 and 2? 65 and 2? 75 and 2? 85 and 2? 95 and 2?

6. A man gave six dollars for a barrel of flour, and two dollars for a box of raisins. How much did he give for both? How many are 6 and 2? 16 and 2?

26 and 2? 86 and 2? 46 and 2? 56 and 2? 66 and 2?  
76 and 2? 86 and 2? 96 and 2?

7. Seven miles of a road are paved, and but two miles are unpaved. How long is the road? How many are 7 and 2? 17 and 2? 27 and 2? 37 and 2?  
47 and 2? 57 and 2? 67 and 2? 77 and 2? 87 and 2?  
97 and 2?

8. Richard is eight years old. How old will he be in two years from this time? How many are 8 and 2?  
18 and 2? 28 and 2? 38 and 2? 48 and 2? 58  
and 2? 68 and 2? 78 and 2? 88 and 2? 98 and 2?

9. Lydia has nine school-books and two picture-books. How many books has she in all? How many are 9 and 2?  
19 and 2? 29 and 2? 39 and 2? 49  
and 2? 59 and 2? 69 and 2? 79 and 2? 89 and 2?  
99 and 2?

10. James found ten chestnuts under a tree, and William found two. How many did they both find? How many are 10 and 2?  
20 and 2? 30 and 2? 40  
and 2? 50 and 2? 60 and 2? 70 and 2? 80 and 2?  
90 and 2? 100 and 2?

11. How many are 2 and 3?  
3 and 3?  
4 and 3?  
5 and 3?  
6 and 3?  
7 and 3?  
8 and 3?  
9 and 3?  
19 and 3?  
29 and 3?  
89 and 3?

12. How many are 2 and 4?  
3 and 4?  
4 and 4?  
5 and 4?  
6 and 4?  
7 and 4?  
8 and 4?  
9 and 4?  
19 and 4?  
39 and 4?  
99 and 4?

13. How many are 2 and 5?  
3 and 5?  
4 and 5?  
5 and 5?  
6 and 5?  
7 and 5?  
8 and 5?  
9 and 5?  
19 and 5?  
29 and 5?  
39 and 5?

14. How many are 2 and 6?  
3 and 6?  
4 and 6?  
5 and 6?  
6 and 6?  
7 and 6?  
8 and 6?  
9 and 6?  
49 and 6?  
69 and 6?  
79 and 6?

15. How many are 2 and 7?  
3 and 7?  
4 and 7?  
5 and 7?  
6 and 7?  
7 and 7?  
8 and 7?  
9 and 7?  
19 and 7?  
59 and 7?  
99 and 7?

16. How many are 2 and 8? 3 and 8? 4 and 8? 5 and 8? 6 and 8? 7 and 8? 8 and 8? 9 and 8? 39 and 8? 49 and 8? 59 and 8?

17. How many are 2 and 9? 3 and 9? 4 and 9? 5 and 9? 6 and 9? 7 and 9? 8 and 9? 9 and 9? 69 and 9? 79 and 9? 89 and 9?

IV.—1. A farmer bought a barrel of flour for five dollars and a hundred weight of sugar for eight dollars. How much did he give for both? How many are 5 and 8?

2. A merchant received from one man eight dollars, from another seven, from another four, from another three, and from another five; how much did he receive in the whole? How many are 8 and 7 and 4 and 3 and 5?

3. Five boys were playing at marbles. James had eight, John had six, William had seven, George had four, and Charles had five. How many had they all? How many are 8 and 6 and 7 and 4 and 5?

4. Lucy received from her mother, two pins at one time, nine at another, six at another, six at another, five at another, eight at another, and seven at another. How many did she receive in the whole? How many are 2 and 9 and 6 and 6 and 5 and 8 and 7?

5. A labourer received nine dollars for the first week, eight dollars for the second week, two dollars for the third, nine dollars for the fourth, five dollars for the fifth, and seven dollars for the sixth. What were his wages for the whole six weeks? How many are 9 and 8 and 2 and 9 and 5 and 7?

6. Sarah gave her teacher four plums, Mary gave her two, Jane gave her five, Eliza gave her seven, and Susan gave her three. How many did the teacher receive? How many are 4 and 2 and 5 and 7 and 3?

7. Some boys were eating plums. The first ate eleven, the second nine, the third nine, the fourth seven, the fifth eight, the sixth eight, the seventh seven, and the eighth four. How many did they all eat? How many are 11 and 9 and 9 and 7 and 8 and 8 and 7 and 4?

8. Maria received from her father three apples, from her mother four, from her brother four, from her sister five, and from her uncle four. How many apples had she? How many are 3 and 4 and 4 and 5 and 4?

9. A grocer sold oil for four dollars, molasses for four dollars, flour for four dollars, and tea for six dollars. How much did he receive for the whole? How many are 4 and 4 and 4 and 6?

10. In a certain school, seven study arithmetic, five study Latin, four study Greek, nine learn to read, and nine learn to write. How many scholars are there? How many are 7 and 5 and 4 and 9 and 9?

11. Clara has nine white pins, six black ones, seven without heads, and she finds three. How many has she in all? How many are 9 and 6 and 7 and 3?

12. Peter has six pears in his right hand, six in his left, eight in his pocket, three in his hat, and nine in his trunk. How many has he in all? How many are 6 and 6 and 8 and 3 and 9?

13. A gentleman paid his grocer, at one time nine dollars, at another five, at another five, at another two, at another eight, and at another one. How much did he pay in all? How many are 9 and 5 and 5 and 2 and 8 and 1?

14. In an orchard there are eleven apple trees, three pear trees, nine peach trees, eight plum trees, one apricot tree, one nectarine tree and six cherry trees. How many trees are there in the orchard? How many are 11 and 3 and 9 and 8 and 1 and 1 and 6?

15. Thomas bought a spelling book for eight cents, a writing book for nine cents, an inkstand for nine cents, and a quill for three cents. How much did he give for the whole? How many are 8 and 9 and 9 and 3?

16. A gentleman bought for his family the following quantities of meat, viz., seven pounds on the first day, eight pounds on the second, three pounds on the third, and two pounds on the fourth. How much did he buy for the whole four days? How many are 7 and 8 and 3 and 2?

17. I paid seven cents for an orange, three cents for an apple, four cents for some raisins, and three cents for some figs. How much did I pay for the whole? How many are 7 and 3 and 4 and 3?

18. How many are 6 and 2 and 7 and 2 and 6 and 3?

V.—1. A boy has one cent, and he spends one cent. How many has he left? 1 from 1 leaves how many?

2. Two apples were on the table, and Mary took one of them. How many did she leave? 1 from 2 leaves how many?

3. Three pigeons were in a dove-cote, and one of them flew away. How many remained? 1 from 3 leaves how many?

4. John had four rabbits, and one of them died. How many had he then? 1 from 4 leaves how many?

5. I had five peaches, and ate one of them. How many had I left? 1 from 5 leaves how many?

6. Joseph found six pins, but one of them had no head. How many had heads? 1 from 6 leaves how many?

7. Seven boys were skating, and one fell down. How many did not fall? 1 from 7 leaves how many?

8. Eliza had eight nuts, one of which was a walnut, and the rest chestnuts. How many chestnuts had she? 1 from 8 leaves how many?

9. A woman had nine apples in a basket, and gave one of them to a poor boy. How many had she left? 1 from 9 leaves how many?

10. Ten boys were reciting, and one of them was sent to his seat. How many continued their lesson? 1 from 10 leaves how many?

11. A gentleman had two cents in his purse, and he gave two cents to a beggar. How many had he left? 2 from 2 leave how many?

12. Thomas, James and William went out to walk, but James and William soon returned home. How many continued their walk? 2 from 3 leave how many?

13. James had four marbles, and lost two of them. How many had he left? 2 from 4 leave how many?

14. George brought five apples from home, and gave two of them away. How many had he left? 2 from 5 leave how many?

15. Six girls were sewing, and two of them laid their work aside. How many continued at work? 2 from 6 leave how many?

16. Jane received seven cents from her mother, and spent two of them. How many had she left? 2 from 7 leave how many?

17. Nathan bought eight apples, and two of them were sour. How many were sweet? 2 from 8 leave how many?

18. A man bought nine barrels of flour, and afterwards sold two of them. How many had he left? 2 from 9 leave how many?

19. Edward picked ten flowers, and gave his sister two of them. How many had he left? 2 from 10 leave how many?

20. There were eleven pears on a tree, but the wind blew two of them off. How many remained on the tree? 2 from 11 leave how many?

Taking one number from another, as we have just been doing, is called SUBTRACTION. The number that is left is called the *Difference* or *Remainder*.

### 21. Repeat the Subtraction table.

1 from 1 leaves 0	2 from 2 leave 0	3 from 3 leave 0
1 from 2 leaves 1	2 from 3 leave 1	3 from 4 leave 1
1 from 3 leaves 2	2 from 4 leave 2	3 from 5 leave 2
1 from 4 leaves 3	2 from 5 leave 3	3 from 6 leave 3
1 from 5 leaves 4	2 from 6 leave 4	3 from 7 leave 4
1 from 6 leaves 5	2 from 7 leave 5	3 from 8 leave 5
1 from 7 leaves 6	2 from 8 leave 6	3 from 9 leave 6
1 from 8 leaves 7	2 from 9 leave 7	3 from 10 leave 7
1 from 9 leaves 8	2 from 10 leave 8	3 from 11 leave 8
1 from 10 leaves 9	2 from 11 leave 9	3 from 12 leave 9

4 from 4 leave 0	5 from 5 leave 0	6 from 6 leave 0
4 from 5 leave 1	5 from 6 leave 1	6 from 7 leave 1
4 from 6 leave 2	5 from 7 leave 2	6 from 8 leave 2
4 from 7 leave 3	5 from 8 leave 3	6 from 9 leave 3
4 from 8 leave 4	5 from 9 leave 4	6 from 10 leave 4
4 from 9 leave 5	5 from 10 leave 5	6 from 11 leave 5
4 from 10 leave 6	5 from 11 leave 6	6 from 12 leave 6
4 from 11 leave 7	5 from 12 leave 7	6 from 13 leave 7
4 from 12 leave 8	5 from 13 leave 8	6 from 14 leave 8
4 from 13 leave 9	5 from 14 leave 9	6 from 15 leave 9

7 from 7 leave 0	8 from 8 leave 0	9 from 9 leave 0
7 from 8 leave 1	8 from 9 leave 1	9 from 10 leave 1
7 from 9 leave 2	8 from 10 leave 2	9 from 11 leave 2
7 from 10 leave 3	8 from 11 leave 3	9 from 12 leave 3
7 from 11 leave 4	8 from 12 leave 4	9 from 13 leave 4
7 from 12 leave 5	8 from 13 leave 5	9 from 14 leave 5
7 from 13 leave 6	8 from 14 leave 6	9 from 15 leave 6
7 from 14 leave 7	8 from 15 leave 7	9 from 16 leave 7
7 from 15 leave 8	8 from 16 leave 8	9 from 17 leave 8
7 from 16 leave 9	8 from 17 leave 9	9 from 18 leave 9

VI.—1. Three boys were sliding on the ice, and three of them fell down. How many did not fall? 3 from 3 leave how many? What is the difference between 3 and 3?

2. Four apples fell from a tree, and Charles picked up three of them. How many did he leave? 3 from 4 leave how many? What is the difference between 3 and 4?

3. James had five marbles, and he gave Edward three of them. How many had he left? 3 from 5 leave how many? What is the difference between 3 and 5?

4. Thomas had six good marks and three bad marks. How many more good ones had he than bad ones? 3 from 6 leave how many? What is the difference between 3 and 6?

5. My father had seven pieces of money, three of which were silver, and the rest copper. How many were copper? If 3 be taken from 7, what is the remainder?

6. Eliza is eight years old, and Sarah is three years younger. How old is Sarah? 3 from 8 leave how many? If 3 be taken from 8, what is the remainder?

7. Richard had nine cents, and his brother had three less. How many had his brother? 3 from 9 leave how many? What is the difference between 3 and 9?

8. A farmer owns ten sheep, three of which are black, and the rest white. How many are white? If 3 be subtracted from 10, what is the remainder?

9. Ruth has eleven books, but only three of them are covered. How many are uncovered? What is the difference between 3 and 11?

10. A carpenter had a rule twelve inches long, but by accident three inches were broken off. How long was the remainder? 3 from 12 leave how many?

11. William bought two marbles and found two more; he then gave four to Charles. How many had he left? 2 and 2 less 4 are how many?

12. Martha received three cents at one time and two at another. She gave four cents for a book; how many had she left? 3 and 2 less 4 are how many?

13. Lucy had three cents, and Jane had three; they gave a poor woman four cents. How many had they left? 3 and 3 less 4 are how many?

14. A boy had four marbles in his right hand, and three in his left; four of them rolled out. How many remained? 4 and 3 less 4 are how many?

15. A grocer had four barrels of flour in his store, and four in his cellar; he sold four barrels; how many had he left? 4 and 4 less 4 are how many?

16. A labourer received five dollars for one week's wages and four dollars for the next. He paid four dollars for two weeks' board; how much had he left? 5 and 4 less 4 are how many?

17. A teacher had five Latin books and five French books. He lent four of them; how many were left? 5 and 5 less 4 are how many?

18. Anna had six black pins and five white ones. She gave away four; how many had she left? 6 and 5 less 4 are how many?

19. Six men and six boys were at work. Four of them went home; how many remained? 6 and 6 less 4 are how many?

20. George received seven plums from his sister, and six from his mother. He ate four of them; how many were left? 7 and 6 less 4 are how many?

VII.—1. 11 and 1 less 3 are how many?

2. 12 and 2 less 5 are how many?

3. 12 and 5 less 4 are how many?

4. 11 and 4 less 7 are how many?

5. 8 and 9 less 3 are how many?

6. 10 and 7 less 8 are how many?

7. 9 and 9 less 6 are how many ?
8. 7 and 6 less 8 are how many ?
9. 9 and 7 less 8 are how many ?
10. 10 and 9 less 5 are how many ?
11. 8 and 6 and 9 less 8 are how many ?
12. 5 and 8 and 9 less 7 are how many ?
13. 6 and 6 and 7 less 9 are how many ?
14. 12 and 4 and 3 less 7 are how many ?
15. 2 and 8 and 6 less 9 are how many ?
16. 3 and 8 and 8 less 6 are how many ?
17. 4 and 9 and 7 less 5 are how many ?
18. 10 and 8 and 7 less 9 are how many ?
19. 9 and 6 and 7 less 8 are how many ?
20. 11 and 7 and 2 less 9 are how many ?
21. 11 and 9 and 2 and 1 less 2 are how many ?
22. 3 and 1 and 6 and 1 less 9 are how many ?
23. 6 and 5 and 2 and 3 less 5 are how many ?
24. 9 and 2 and 6 and 3 less 7 are how many ?
25. 12 and 9 and 3 and 1 less 4 are how many ?
26. 3 and 2 and 9 and 4 less 3 are how many ?
27. 7 and 7 and 2 and 8 less 6 are how many ?
28. 2 and 3 and 6 and 5 less 7 are how many ?
29. 6 and 2 and 8 and 9 less 5 are how many ?
30. 15 and 1 and 1 and 8 less 6 are how many ?
31. 9 and 1 and 3 and 4 and 9 less 1 are how many ?
32. 12 and 6 and 1 and 8 and 1 less 9 are how many ?
33. 8 and 5 and 5 and 6 and 7 less 2 are how many ?
34. 10 and 5 and 3 and 4 and 9 less 3 are how many ?
35. 4 and 3 and 2 and 5 and 8 less 6 are how many ?
36. 8 and 3 and 8 and 3 and 5 less 9 are how many ?

37. 6 and 4 and 4 and 1 and 2 less 5 are how many?

38. 5 and 4 and 6 and 5 and 3 less 4 are how many?

39. 4 and 5 and 8 and 4 and 7 less 2 are how many?

40. 6 and 7 and 4 and 5 and 9 less 8 are how many?

41. How many are 11 less 1? 12 less 4? 16 less 6? 21 less 5? 22 less 1? 12 less 2? 31 less 4? 15 less 8? 5 less 3? 24 less 4? 14 less 9? 33 less 9? 17 less 6? 27 less 7? 10 less 1? 20 less 8? 19 less 4? 13 less 3? 11 less 6? 21 less 7? 22 less 9? 12 less 5? 3 less 1? 13 less 6?

42. What is the difference between 14 and 8? 24 and 3? 7 and 34? 44 and 2? 54 and 1? 7 and 13? 2 and 15? 25 and 1? 4 and 6? 16 and 2? 26 and 3? 17 and 1? 2 and 27? 1 and 8? 5 and 28? 4 and 18? 18 and 7? 19 and 8? 19 and 3? 2 and 29? 39 and 1? 6 and 16? 4 and 20? 2 and 30? 40 and 3?

VIII.—1. James had five apples, and Charles had three. How many had James more than Charles? A man gave each of them ten more. How many had they then? How many had James more than Charles?

2. 3 from 5 leave how many? 13 from 15 leave how many?

3. Seven boys were studying Latin, and four were studying Greek. How many more studied Latin than Greek? If ten more were added to each class, how many would there be? How many more in Latin than in Greek?

4. 7 less 4 are how many? 17 less 14 are how many?

5. Susan had nine chestnuts and five walnuts. How many more chestnuts had she than walnuts? Her mother gave her ten more of each. How many had she then? How many more chestnuts than walnuts?

6. 5 from 9 leave how many? 15 from 19 leave how many?

7. A farmer brought six bushels of wheat and one bushel of rye to market. How much more wheat had he than rye? If he had ten bushels more of each, how much would he have? How much more wheat than rye?

8. 1 from 6 leaves how many? 11 from 16 leave how many?

9. There were ten girls and four boys in a certain school. How many more girls were there than boys? If there were ten more of each, how many would there be? How many more girls than boys?

10. 10 less 4 are how many? 20 less 14 are how many?

11. Nine men and sixteen boys were at work together. How many more boys were there than men? Ten men and ten boys came to assist them. How many were there then of each? How many more boys than men?

12. What is the difference between 9 and 16? 19 and 26?

13. William is seventeen years old, and Thomas is nine. How much older is William than Thomas? How old will they each be in ten years from this time? How much older will William be than Thomas?

14. What is the difference between 17 and 9? 27 and 19?

15. Jane is fourteen years old, and Eliza is five. How much older is Jane than Eliza? How old will each be, ten years hence? How much older will Jane be than Eliza?

16. 14 less 5 are how many? 24 less 15 are how many?

17. Mary has twelve quills, and Julia has two. Which has the most, and how many? If their teacher should give each of them ten more, how many would they then have? How many more would Mary have than Julia?

18. 12 less 2 are how many? 22 less 12 are how many?

19. If ten be added to two numbers, will their difference be the same?

20. What is the difference between 5 and 7? Add 1 to each number, and what will be the difference?

21. What is the difference between 5 and 8? Add 2 to each number, and what will be the difference?

22. What is the difference between 4 and 8? Add 3 to each number, and what will be the difference?

23. What is the difference between 4 and 9? Add 4 to each number, and what will be the difference?

24. What is the difference between 3 and 6? Add 5 to each number, and what will be the difference?

25. What is the difference between 2 and 9? Add 6 to each number, and what will be the difference?

26. What is the difference between 5 and 8? Add 7 to each number, and what will be the difference?

27. What is the difference between 9 and 12? Add 8 to each number, and what will be the difference?

28. What is the difference between 8 and 14? Add 9 to each number, and what will be the difference?

29. If we add any number whatever, to each of two numbers, will their difference be the same?

**IX.—1.** 4 tens and 5 tens are how many tens?

2. 40 and 50 are how many?

3. 4 tens from 9 tens leave how many tens? 5 tens from 9 tens leave how many tens?

4. 40 from 90 leave how many? 50 from 90 leave how many?

5. 8 tens and 3 tens are how many tens?

6. 80 and 30 are how many?

7. 11 tens less 3 tens are how many tens? 11 tens less 8 tens are how many tens?

8. 110 less 30 are how many ? 110 less 80 are how many ?

9. 6 tens and 2 tens are how many tens ?

10. 60 and 20 are how many ?

11. 8 tens less 6 tens are how many tens ? 8 tens less 2 tens are how many tens ?

12. 80 less 60 are how many ? 80 less 20 are how many ?

13. 5 tens and 7 tens are how many tens ?

14. 50 and 70 are how many ?

15. 12 tens less 5 tens are how many tens ? 12 tens less 7 tens are how many tens ?

16. 120 less 50 are how many ? 120 less 70 are how many ?

17. 9 tens and 4 tens are how many tens ?

18. 90 and 40 are how many ?

19. 13 tens less 9 tens are how many ? 13 tens less 4 tens are how many ?

20. 130 less 90 are how many ? 130 less 40 are how many ?

21. 8 tens and 7 tens are how many tens ?

22. 80 and 70 are how many ?

23. 8 tens from 15 tens leave how many ? 7 tens from 15 tens leave how many ?

24. 80 from 150 leave how many ? 70 from 150 leave how many ?

25. 7 tens and 9 tens are how many tens ?

26. 70 and 90 are how many ?

27. 7 tens from 16 tens leave how many ? 9 tens from 16 tens leave how many ?

28. 70 from 160 leave how many ? 90 from 160 leave how many ?

29. 8 tens and 9 tens are how many tens ?

30. 80 and 90 are how many ?

31. 17 tens less 8 tens are how many ? 17 tens less 9 tens are how many ?
32. 170 less 80 are how many ? 170 less 90 are how many ?
33. 5 tens and 6 tens are how many tens ?
34. 50 and 60 are how many ?
35. 5 tens from 11 tens leave how many ? 6 tens from 11 tens leave how many ?
36. 50 from 110 leave how many ? 60 from 110 leave how many ?
37. 6 tens and 4 tens are how many tens ?
38. 60 and 40 are how many ?
39. What is the difference between 10 tens and 6 tens ? 10 tens and 4 tens ?
40. What is the difference between 100 and 60 ? 100 and 40 ?
41. 8 tens and 5 tens are how many tens ?
42. 80 and 50 are how many ?
43. What is the difference between 13 tens and 8 tens ? 13 tens and 5 tens ?
44. What is the difference between 130 and 80 ? 130 and 50 ?
45. 9 tens and 6 tens are how many tens ?
46. 90 and 60 are how many ?
47. 9 tens from 15 tens leave how many ? 6 tens from 15 tens leave how many ?
48. 90 from 150 leave how many ? 60 from 150 leave how many ?
49. 8 tens and 6 tens are how many tens ?
50. 80 and 60 are how many ?
51. 14 tens less 8 tens are how many ? 14 tens less 6 tens are how many ?
52. 140 less 80 are how many ? 140 less 60 are how many ?

53. 5 tens and 9 tens are how many tens ?
54. 50 and 90 are how many ?
55. What is the difference between 14 tens and 5 tens ? 14 tens and 9 tens ?
56. What is the difference between 140 and 50 ? 140 and 90 ?
57. 7 tens and 6 tens are how many tens ?
58. 70 and 60 are how many ?
59. What is the difference between 6 tens and 13 tens ? 7 tens and 13 tens ?
60. What is the difference between 60 and 130 ? 70 and 130 ?
61. How many are 40 and 80 ?

X.—1. James had three apples and four pears, and John had four apples and two pears. How many apples, and how many pears had both ?

2. How many apples, and how many pears, are 3 apples and 4 apples, and 4 pears and 2 pears ?
3. How many tens, and how many units, are 3 tens and 4 tens, and 4 units and 2 units ?
4. How many are 30 and 40 and 4 and 2 ? How many are 34 and 42 ?
5. Laura had four walnuts and one chestnut, and Ann had three walnuts and two chestnuts. How many walnuts, and how many chestnuts had both ?
6. How many tens, and how many units, are 4 tens and 1 unit, and 3 tens and 2 units ? How many are 41 and 32 ?
7. George had saved 41 cents, and a gentleman gave him 32 more. How many had he then ?
8. Catherine had six pins and three needles, and Celia had two pins and four needles. How many pins and how needles had they both ?

9. How many tens, and how many units, are 6 tens and 3 units, and 2 tens and 4 units? How many are 63 and 24?

10. Mary has learned 63 pages in her spelling book, and she has 24 more to learn. How many pages are there in the book?

11. A woman had eight pins and seven needles, and she gave her daughter six pins and three needles. How many of each had she left?

12. 8 tens and 7 units, less 6 tens and 3 units, are how many? 87 less 63 are how many?

13. A grocer had three bags of coffee and four bags of sugar, and he bought five bags of coffee and two bags of sugar. How many bags of each did he then have?

14. How many tens, and how many units, are there in 3 tens and 4 units, and 5 tens and 2 units? 34 and 52 are how many?

15. A gentleman bought eight yards of broadcloth and six yards of cassimere, and he used three yards of broadcloth and four yards of cassimere. How many yards of each had he left?

16. 8 tens and 6 units, less 3 tens and 4 units, are how many? 86 less 34 are how many?

17. Martha had five quills and three pencils, and Charlotte had two quills and five pencils. How many quills, and how many pencils, had they both?

18. How many tens, and how many units, are there in 5 tens and 3 units, and 2 tens and 5 units? 53 and 25 are how many?

19. A man had seven dimes and eight cents, and he spent five dimes and three cents. How much had he left?

20. 7 tens and 8 units, less 5 tens and 3 units, are how many? 78 less 53 are how many?

21. William had nine marbles and five bullets, and Benjamin had six marbles and no bullets. How many marbles, and how many bullets, had they both?

22. 9 tens and 5 units, and 6 tens and 0 units, are how many tens, and how many units? 95 and 60 are how many?

23. There were fifteen apple trees, and five pear trees, in an orchard. Nine of the apple trees, and five pear trees, bore no fruit. How many of each bore fruit?

24. 15 tens and 5 units, less 9 tens and 5 units, are how many? 155 less 95 are how many?

XI.—1. If one apple costs two cents, how much will two apples cost? 2 and 2 are how many? 2 times 2 are how many?

2. If an orange costs two cents, how much will three oranges cost? 2 and 2 and 2 are how many? 3 times 2 are how many?

3. Louisa receives two cents a week. How much will she receive in four weeks? 2 and 2 and 2 and 2 are how many? 4 times 2 are how many?

4. How many eyes have five boys? 5 times 2 are how many?

5. How many hands have six girls? 6 times 2 are how many?

6. If one quill costs two cents, how much will seven quills cost? 7 times 2 are how many?

7. A boy receives two cents for carrying a parcel. How much will he receive for eight parcels? 8 times 2 are how many?

8. When apples are two dollars a barrel, how much will nine barrels cost? 9 times 2 are how many?

9. Charles put two rings on each of his fingers and thumbs. How many had he on both hands? 10 times 2 are how many?

Repeating a number as we have now been doing, is called MULTIPLICATION. The answer is called the *product*.

10. Repeat the multiplication table.

2 times	1 are	2	3 times	1 are	3	4 times	1 are	4
2 times	2 are	4	3 times	2 are	6	4 times	2 are	8
2 times	3 are	6	3 times	3 are	9	4 times	3 are	12
2 times	4 are	8	3 times	4 are	12	4 times	4 are	16
2 times	5 are	10	3 times	5 are	15	4 times	5 are	20
2 times	6 are	12	3 times	6 are	18	4 times	6 are	24
2 times	7 are	14	3 times	7 are	21	4 times	7 are	28
2 times	8 are	16	3 times	8 are	24	4 times	8 are	32
2 times	9 are	18	3 times	9 are	27	4 times	9 are	36
2 times	10 are	20	3 times	10 are	30	4 times	10 are	40

5 times	1 are	5	6 times	1 are	6	7 times	1 are	7
5 times	2 are	10	6 times	2 are	12	7 times	2 are	14
5 times	3 are	15	6 times	3 are	18	7 times	3 are	21
5 times	4 are	20	6 times	4 are	24	7 times	4 are	28
5 times	5 are	25	6 times	5 are	30	7 times	5 are	35
5 times	6 are	30	6 times	6 are	36	7 times	6 are	42
5 times	7 are	35	6 times	7 are	42	7 times	7 are	49
5 times	8 are	40	6 times	8 are	48	7 times	8 are	56
5 times	9 are	45	6 times	9 are	54	7 times	9 are	63
5 times	10 are	50	6 times	10 are	60	7 times	10 are	70

8 times	1 are	8	9 times	1 are	9	10 times	1 are	10
8 times	2 are	16	9 times	2 are	18	10 times	2 are	20
8 times	3 are	24	9 times	3 are	27	10 times	3 are	30
8 times	4 are	32	9 times	4 are	36	10 times	4 are	40
8 times	5 are	40	9 times	5 are	45	10 times	5 are	50
8 times	6 are	48	9 times	6 are	54	10 times	6 are	60
8 times	7 are	56	9 times	7 are	63	10 times	7 are	70
8 times	8 are	64	9 times	8 are	72	10 times	8 are	80
8 times	9 are	72	9 times	9 are	81	10 times	9 are	90
8 times	10 are	80	9 times	10 are	90	10 times	10 are	100

XII.—1. A miller sold nine barrels of flour at five dollars a barrel. How much did he receive for the whole? 9 times 5 are how many? 5 times 9 are how many?

2. If an orange costs four cents, how much will eight oranges cost? 4 times 8 are how many? 8 times 4 are how many?

3. Thomas, James and William, have each nine marbles. How many have they together? 3 times 9 are how many? 9 times 3 are how many?

4. When cider is two dollars a barrel, how much will nine barrels cost? 9 times 2 are how many? 2 times 9 are how many?

5. Harry has eight marbles in each hand; how many has he in both? 2 times 8 are how many? 8 times 2 are how many?

6. How many hands have six men? 6 times 2 are how many? 2 times 6 are how many?

7. How many feet have seven horses? 7 times 4 are how many? 4 times 7 are how many?

8. Mary has three cents a week; how much will she receive in eight weeks? 8 times 3 are how many? 3 times 8 are how many?

9. There were four classes in a certain school, and six boys in each class. How many were there in the school? 4 times 6 are how many? 6 times 4 are how many?

10. If a family eat three pounds of meat a day, how much will they eat a week? 7 times 3 are how many? 3 times 7 are how many?

11. How many legs have four tables? 4 times 4 are how many?

12. If an apple costs two cents, how much will three apples cost? five apples? seven apples? four

apples? How many are 2 times 3? 3 times 2? 5 times 2? 2 times 5? 7 times 2? 2 times 7? 4 times 2? 2 times 4?

13. How much will a labourer receive in three weeks, if his wages are three dollars a week? How much in six weeks? four weeks? How many are 3 times 3? 6 times 3? 3 times 6? 4 times 3? 3 times 4?

14. When flour is five dollars a barrel, how much must I give for three barrels? for five barrels? eight barrels? four barrels? How many are 3 times 5? 5 times 3? 5 times 5? 8 times 5; 5 times 8? 4 times 5? 5 times 4?

15. How much must I give for six pounds of raisins, at six cents a pound? How much for eight pounds? five pounds? nine pounds? seven pounds? How many are 6 times 6? 8 times 6? 6 times 8? 5 times 6? 6 times 5? 9 times 6? 6 times 9? 7 times 6? 6 times 7?

16. How many days are there in seven weeks? nine weeks? five weeks? eight weeks? How many are 7 times 7? 9 times 7? 7 times 9? 5 times 7? 7 times 5? 8 times 7? 7 times 8?

17. If a ship sails nine miles an hour, how far will it sail in eight hours? four hours? nine hours? How many are 8 times 9? 9 times 8? 4 times 9? 9 times 4? 9 times 9?

18. What will five yards of broadcloth cost, at eight dollars a yard? seven yards? three yards? eight yards? How many are 5 times 8? 8 times 5? 7 times 8? 8 times 7? 3 times 8? 8 times 3? 8 times 8?

XIII.—1. 2 times 5 are how many? 5 times 2 are how many?

2. 8 times 8 are how many? 8 times 8 are how many?

3. 4 times 2 are how many? 2 times 4 are how many?

4. 7 times 4 are how many? 4 times 7 are how many?

5. 3 times 9 are how many? 9 times 3 are how many?

6. 8 times 2 are how many? 2 times 8 are how many?

7. 3 times 3 are how many? 3 times 4 are how many? 4 times 3 are how many?

8. 2 times 7 are how many? 7 times 2 are how many?

9. 4 times 4 are how many? 4 times 8 are how many? 8 times 4 are how many?

10. How many are 5 times 5? 8 times 8? 6 times 6? 9 times 9? 7 times 7?

11. How many are 5 times 4? 4 times 5? 6 times 3? 3 times 6? 2 times 9? 9 times 2?

12. How many are 2 times 3? 3 times 2? 6 times 2? 2 times 6? 3 times 7? 7 times 3?

13. How many are 9 times 8? 8 times 9? 7 times 6? 6 times 7? 3 times 5? 5 times 3?

14. How many are 3 times 7? 7 times 3? 6 times 4? 4 times 6? 5 times 9? 9 times 5?

15. How many are 4 times 9? 9 times 4? 6 times 8? 8 times 6? 7 times 5? 5 times 7?

16. How many are 6 times 5? 5 times 6? 7 times 9? 9 times 7? 9 times 6? 6 times 9?

17. 2 times 9 tens are how many tens? How many are 2 times 90? 90 times 2?

18. 6 times 3 tens are how many tens? How many are 6 times 30? 30 times 6?

19. 3 times 5 tens are how many tens? How many are 3 times 50? 50 times 3?

20. 8 times 3 tens are how many tens? How many are 8 times 30? 30 times 8?
21. 4 times 6 tens are how many tens? How many are 4 times 60? 60 times 4?
22. 6 times 4 tens are how many tens? How many are 6 times 40? 40 times 6?
23. 2 times 6 tens are how many tens? How many are 2 times 60? 60 times 2?
24. 6 times 2 tens are how many tens? How many are 6 times 20? 20 times 6?
25. 4 times 3 tens are how many tens? How many are 4 times 30? 30 times 4?
26. 3 times 4 tens are how many tens? How many are 3 times 40? 40 times 3?
27. 4 times 4 tens are how many tens? How many are 4 times 40? 40 times 4?
28. 8 times 2 tens are how many tens? How many are 8 times 20? 20 times 8?
29. 2 times 8 tens are how many tens? How many are 2 times 80? 80 times 2?
30. 7 times 2 tens are how many tens? How many are 7 times 20? 20 times 7?
31. 2 times 7 tens are how many tens? How many are 2 times 70? 70 times 2?
32. What is the difference between 4 times 5 tens and 5 times 4 tens?
33. What is the difference between 4 times 50 and 5 times 40?
34. Which is the larger, 4 times 7 tens or 7 times 4 tens?
35. Which is the larger, 4 times 70 or 7 times 40?
36. How many are 3 times 90? 90 times 3? 9 times 30? 30 times 9?
37. How many are 4 times 80? 80 times 4? 8 times 40? 40 times 8?

38. How many are 5 times 20? 20 times 5? 2 times 50? 50 times 2?

39. How many are 9 times 40? 40 times 9? 4 times 90? 90 times 4?

40. How many are 5 times 60? 60 times 5? 6 times 50? 50 times 6?

41. How many are 7 times 90? 90 times 7? 9 times 70? 70 times 9?

42. How many are 8 times 50? 50 times 8? 5 times 80? 80 times 5?

43. How many are 6 times 70? 70 times 6? 7 times 60? 60 times 7?

44. How many are 7 times 50? 50 times 7? 5 times 70? 70 times 5?

45. How many are 9 times 80? 80 times 9? 8 times 90? 90 times 8?

46. How many are 5 times 50? 60 times 6? 70 times 7? 8 times 80? 9 times 90?

47. How many are 2 times 20? 30 times 2? 40 times 2? 3 times 30? 80 times 6? 70 times 8? 60 times 9? 9 times 50?

From the two foregoing sections, we may learn that *when two numbers are to be multiplied together, it is immaterial which we multiply by. It is generally easier to multiply by the smaller number.*

XIV.—1. Charlotte gave ten cents for a ruler, and four cents for an inkstand. How much did she give for both? How much must she give for two rulers and two inkstands?

2. 10 and 4 are how many? 2 times 10 and 2 times 4 are how many? 2 times 14 are how many?

3. If a slate costs ten cents, and a slate pencil costs one cent, how much will they both cost? How much would three slates and three pencils cost?

4. How many are 10 and 1? 3 times 10 and 3 times 1? 3 times 11?

5. A barrel of sugar is worth ten dollars, and a barrel of apples is worth two dollars. How much are they both worth? How much would three barrels of sugar and three barrels of apples be worth?

6. Charles has twenty marbles in one pocket, and three in the other. How many has he in both? If he had four times as many, how many would he then have?

7. How many are 20 and 3? 4 times 20 and 4 times 3? 4 times 23?

8. How many are 5 times 3? 5 times 20? 5 times 3 and 5 times 20? 5 times 23?

9. Laura's father gave her ten cents, and her mother gave her six. How much did they both give her? If they had each given her six times as much, how much would she have had?

10. How many are 10 and 6? 6 times 10 and 6 times 6? 6 times 16?

11. Sixteen ounces make one pound. How many ounces are there in six pounds? In 6 pounds and 1 ounce? 6 pounds and 2 ounces? 6 pounds and 4 ounces?

12. How many ounces are there in five pounds? In 5 pounds and 3 ounces? 5 pounds and 5 ounces? 5 pounds and 7 ounces? 5 pounds and 10 ounces?

13. How many ounces are there in eight pounds? In 8 pounds and 10 ounces? 8 pounds and 11 ounces? 8 pounds and 12 ounces? 8 pounds and 13 ounces?

14. How many ounces are there in ten pounds? In 10 pounds and 15 ounces?

15. Twelve inches make one foot. How many inches are there in seven feet? In 7 feet and 1 inch? 7 feet and 2 inches? 7 feet and 3 inches? 7 feet and 6 inches?

16. How many inches are there in nine feet? In ten feet? 10 feet and 10 inches? 10 feet and 11 inches? 11 feet? 11 feet and 5 inches?

17. Twenty-four hours make one day. How many hours are there in five days? In 5 days and 6 hours? 5 days and 10 hours? 5 days and 12 hours? 5 days and 16 hours?

18. How many hours are there in eight days? 8 days and 1 hour? 8 days and 7 hours? 8 days and 23 hours? 9 days?

19. Thirty days make one month. How many days are there in three months? 3 months and 10 days? 3 months and 20 days? 3 months and 25 days? 3 months and 29 days?

20. How many days are there in seven months? 7 months and 11 days? 7 months and 21 days? 7 months and 29 days? 8 months?

21. Four quarts make one gallon. How many quarts are there in 15 gallons? 17 gallons and 3 quarts? 17 gallons and 1 quart?

22. How many quarts are there in 21 gallons? 24 gallons? 24 gallons and 2 quarts? 27 gallons and 1 quart?

23. If one ton of hay cost 14 dollars, how much will 5 tons cost? 6 tons? 7 tons?

24. Thirty-two quarts make one bushel. How many quarts are there in 2 bushels? 3 bushels? 3 bushels and 10 quarts? 3 bushels and 20 quarts?

25. Sixty minutes make one hour. How many minutes are there in 4 hours? 6 hours? 7 hours and 10 minutes? 7 hours and 20 minutes? 7 hours and 40 minutes? 8 hours and 10 minutes?

26. How many are 5 times 17? 6 times 15? 7 times 13? 9 times 14? 8 times 14? 7 times 16? 5 times 19? 9 times 12? 6 times 18? 5 times 28? 3 times 37? 2 times 99? 9 times 22?

XV.—1. If I pay one cent for an apple, how many can I buy for 2 cents? How many for 3 cents? for 4 cents? for 5 cents?

2. 1 is contained in 2 how many times? in 3? in 4? in 5?

3. If a steel pen costs two cents, how many can be bought for 4 cents? How many for 6 cents? for 8 cents? for 10 cents? for 12 cents?

4. How many times are 2 contained in 4? in 6? 8? 10? 12?

5. If I walk two miles an hour, how long will it take me to walk 14 miles? how long to walk 16 miles? 18 miles? 20 miles?

6. How many times are 2 contained in 14? in 16? 18? 20?

7. Three feet make one yard. How many yards are there in 6 feet? in 9 feet? in 12 feet? in 15 feet?

8. How many times are 3 contained in 6? in 9? 12? 15?

9. A gentleman gave eighteen apples to three little boys? How many did he give them apiece?

10. How many times are 3 contained in 18? in 21? 24? 27? 30?

11. 8 is how many times 4? 12 is how many times 4? 16 is how many times 4? 20 is how many times 4?

12. 24 is how many times 4? 28 is how many times 4? 32 is how many times 4? 36 is how many times 4? 40 is how many times 4?

13. Five cents make one half-dime. How many half-dimes are there in 10 cents? in 15 cents? in 20 cents? in 25 cents?

14. How many times 5 in 30? in 35? in 40? in 45? in 50?

Finding how many times one number is contained in another, as we have just been doing, is called **Division**. The answer is called the *Quotient*.

**15. Repeat the division table.**

2 in 2 1 time,	3 in 3 1 time,	4 in 4 1 time,
2 in 4 2 times,	3 in 6 2 times,	4 in 8 2 times,
2 in 6 3 times,	3 in 9 3 times,	4 in 12 3 times,
2 in 8 4 times,	3 in 12 4 times,	4 in 16 4 times,
2 in 10 5 times,	3 in 15 5 times,	4 in 20 5 times,
2 in 12 6 times,	3 in 18 6 times,	4 in 24 6 times,
2 in 14 7 times,	3 in 21 7 times,	4 in 28 7 times,
2 in 16 8 times,	3 in 24 8 times,	4 in 32 8 times,
2 in 18 9 times,	3 in 27 9 times,	4 in 36 9 times,
2 in 20 10 times.	3 in 30 10 times.	4 in 40 10 times.

5 in 5 1 time,	6 in 6 1 time,	7 in 7 1 time,
5 in 10 2 times,	6 in 12 2 times,	7 in 14 2 times,
5 in 15 3 times,	6 in 18 3 times,	7 in 21 3 times,
5 in 20 4 times,	6 in 24 4 times,	7 in 28 4 times,
5 in 25 5 times,	6 in 30 5 times,	7 in 35 5 times,
5 in 30 6 times,	6 in 36 6 times,	7 in 42 6 times,
5 in 35 7 times,	6 in 42 7 times,	7 in 49 7 times,
5 in 40 8 times,	6 in 48 8 times,	7 in 56 8 times,
5 in 45 9 times,	6 in 54 9 times,	7 in 63 9 times,
5 in 50 10 times.	6 in 60 10 times.	7 in 70 10 times.

8 in 8 1 time,	9 in 9 1 time,	10 in 10 1 time,
8 in 16 2 times,	9 in 18 2 times,	10 in 20 2 times,
8 in 24 3 times,	9 in 27 3 times,	10 in 30 3 times,
8 in 32 4 times,	9 in 36 4 times,	10 in 40 4 times,
8 in 40 5 times,	9 in 45 5 times,	10 in 50 5 times,
8 in 48 6 times,	9 in 54 6 times,	10 in 60 6 times,
8 in 56 7 times,	9 in 63 7 times,	10 in 70 7 times,
8 in 64 8 times,	9 in 72 8 times,	10 in 80 8 times,
8 in 72 9 times,	9 in 81 9 times,	10 in 90 9 times,
8 in 80 10 times.	9 in 90 10 times.	10 in 100 10 times.

XVI.—1. If 20 apples be divided among 4 boys, how many will each receive? 20 divided by 4 are how many? 20 divided by 5 are how many?

2. If nine barrels of flour cost 54 dollars, how much does one barrel cost? 54 divided by 9 are how many? 54 divided by 6 are how many?

3. If 8 yards of broadcloth cost 56 dollars, how much will one yard cost? 56 divided by 8 are how many? 56 divided by 7 are how many?

4. A courier rode 72 miles in 9 hours; how far did he ride in one hour? 72 divided by 9 are how many? 72 divided by 8 are how many?

5. There are 28 trees in an orchard, and 4 trees in a row. How many rows are there? 28 divided by 4 are how many? 28 divided by 7 are how many?

6. In a certain orchard there are 81 trees, and 9 trees in each row. How many rows are there? 81 divided by 9 are how many?

7. A grocer sold 9 boxes of raisins for 27 dollars. What was the price of one box? 27 divided by 9 are how many? 27 divided by 3 are how many?

8. Four pecks make one bushel. How many bushels are there in 32 pecks? 32 are how many times 4? how many times 8?

9. A dime is worth ten cents. How many dimes are worth 50 cents? 50 divided by 10 are how many? 50 divided by 5 are how many?

10. A labourer receives 9 dollars a month. How long will it take him to earn 63 dollars? 63 are how many times 9? how many times 7?

11. A gentleman paid 64 cents for raisins that were worth 8 cents a pound. How many pounds did he buy? 64 are how many times 8?

12. How many tons of coal, at 7 dollars a ton, can I buy for 49 dollars? for 35 dollars? How many are 49 divided by 7? 35 divided by 7?

13. How many weeks are there in 21 days? In 42 days? 21 are how many times 7? 42 are how many times 7? how many times 6?

14. A stage-coach goes six miles an hour. How long will it take to go 36 miles? 24 miles? 48 miles? How many times 6 in 36? in 24? in 48?

15. If a locomotive goes 5 miles in half an hour, how many half hours will it take to go 25 miles? 30 miles? 45 miles? 40 miles?

16. How many are 25 divided by 5? 30 divided by 5? 45 divided by 5? 40 divided by 5?

17. If a horse eats 6 quarts of oats in one day, in how many days will it eat 60 quarts? 42 quarts? 60 are how many times 6? 42 are how many times 6?

18. If ten pecks of flour fill one barrel, how many barrels may be filled with 90 pecks? with 70 pecks? 100 pecks? 80 pecks? 10 is contained in 90 how many times? In 70? In 100? In 80?

19. If you pay 9 cents to see the menagerie, how many times can you see it for 90 cents? For 63 cents? For 18 cents? For 54 cents? For 72 cents? How many times 9 are 90? 63? 18? 54? 72?

20. Five cents make a half dime. How many half dimes are there in 50 cents? In 25 cents? In 15 cents? 10 cents? 40 cents? How many times 5 are 50? 25? 15? 10? 40?

21. Eight quarts make one peck. How many pecks are there in 24 quarts? In 16 quarts? In 48 quarts? In 64 quarts? How many are 24 divided by 8? 16 divided by 8? 48 divided by 8? 64 divided by 8?

22. Four pecks make one bushel. How many bushels are there in 40 pecks? In 16 pecks? In 36

pecks? 40 are how many times 4? 16 are how many times 4? 36 are how many times 4?

23. If Peter learns seven lessons every day, in how many days will he learn 14 lessons? 56 lessons? 35 lessons? 49 lessons? 42 lessons? How many times 7 are 14? 56? 35? 49? 42?

24. If one yoke of oxen will plough nine acres of ground, how many yokes will plough 81 acres in the same time? How many will plough 45 acres? 81 divided by 9 are how many? 45 divided by 9?

25. How many are 60 divided by 6? 36 divided by 6? 70 divided by 7? 100 divided by 10? 80 divided by 10? 30 divided by 6? 20 divided by 2?

26. 24 tens divided by 4 are how many tens? 24 tens divided by 4 tens are how many?

27. How many are 240 divided by 4? 240 divided by 40?

28. How many are 18 tens divided by 6? 18 tens divided by 6 tens?

29. How many are 180 divided by 6? 180 divided by 60?

30. How many are 21 tens divided by 7? by 7 tens?

31. How many are 210 divided by 7? by 70?

32. How many are 25 tens divided by 5? by 5 tens?

33. How many are 250 divided by 5? by 50?

34. How many are 56 tens divided by 8? by 8 tens?

35. How many are 560 divided by 8? by 80?

36. How many are 36 tens divided by 9? by 9 tens?

37. How many are 360 divided by 9? by 90?

38. How many are 70 tens divided by 10? by 10 tens?

39. How many are 700 divided by 10? by 100?

40. How many are 810 divided by 9? by 90?

XVII.—1. If I divide one apple among two boys, how much can I give to each? How much is one divided by 2? One-half is written  $\frac{1}{2}$ .

2. If an orange be divided among four boys, how much will each receive? How much is 1 divided by 4? One-fourth is written  $\frac{1}{4}$ .

When anything is divided into two equal parts, one of those parts is called *one-half*, which is written  $\frac{1}{2}$ . If it is divided into three parts, one part is called *one-third*, written  $\frac{1}{3}$ . If in four parts, one part is *one-fourth*, written  $\frac{1}{4}$ . If in five parts, one part is *one-fifth*, or  $\frac{1}{5}$ , and so on.\*

3. Mary wishes to divide an apple among six of her playmates. How much can she give to each? How much is 1 divided by 6? How many sixths make a whole one?

4. If a barrel of flour be divided equally among five men, how much will each man receive? How much is 1 divided by 5? How many fifths make a whole one?

5. If a pound of raisins costs five cents, how much will  $\frac{1}{2}$  of a pound cost? How much will  $\frac{1}{3}$ ?  $\frac{2}{3}$ ?  $\frac{4}{5}$ ?  $\frac{5}{6}$ ?

6. Eliza wishes to give three of her companions some candy. How much can she give to each, if she divides one stick among them? How much if she divides two sticks? How much is 1 divided by 3? 2 divided by 3? How many thirds make a whole one?

7. A gentleman wished to distribute some bread among seven beggars. How much can he give to each, if he divides one loaf among them? How much if he divides two loaves? 3 loaves? 4 loaves? 5 loaves? 6 loaves? 7 loaves? How much is 1 divided

\* The teacher should illustrate the principles of fractions, as far as may be necessary, by the actual division of an apple, a line on the board, or such other method as is most convenient.

by 7? 2 divided by 7? 3 divided by 7? 4 divided by 7? 5 divided by 7? 6 divided by 7? 7 divided by 7?  
How many sevenths make a whole one?

8. What is one-seventh of one?  $\frac{1}{7}$  of 2?  $\frac{1}{7}$  of 3?  $\frac{1}{7}$  of 4?  $\frac{1}{7}$  of 5?  $\frac{1}{7}$  of 6?  $\frac{1}{7}$  of 7?

9. Eight boys go to gather chestnuts. How many ought each to receive, if they find but one quart? How many if they find two quarts? 3 quarts? 6 quarts? 7 quarts? 8 quarts? How much is 1 divided by 8? 2 divided by 8? 3 divided by 8? 6 divided by 8? 7 divided by 8? 8 divided by 8? How many eighths make a whole one?

10. What is one-eighth of one?  $\frac{1}{8}$  of 2?  $\frac{1}{8}$  of 3?  $\frac{1}{8}$  of 6?  $\frac{1}{8}$  of 7?  $\frac{1}{8}$  of 8?

11. Nine families consume a barrel of flour in one week. What part of a barrel will one family consume in one week? In 2 weeks? In 3 weeks? In 7 weeks? In 9 weeks? How many ninths make a whole one?

12. What is one-ninth of one?  $\frac{1}{9}$  of 2?  $\frac{1}{9}$  of 3?  $\frac{1}{9}$  of 7?  $\frac{1}{9}$  of 9?

13. If ten horses eat a ton of hay in a month, what part of a ton will one horse eat in one month? What part in two months? 3 months? 4 months? 5 months? 6 months? 7 months? 8 months? 9 months? 10 months?

14. How much is one divided by ten? 2 divided by 10? 3 divided by 10? 4 divided by 10? 5 divided by 10? 6 divided by 10? 7 divided by 10? 8 divided by 10? 9 divided by 10? 10 divided by 10? How many tenths make a whole one?

15. What is one tenth of one?  $\frac{1}{10}$  of 2?  $\frac{1}{10}$  of 3?  $\frac{1}{10}$  of 4?  $\frac{1}{10}$  of 5?  $\frac{1}{10}$  of 6?  $\frac{1}{10}$  of 7?  $\frac{1}{10}$  of 8?  $\frac{1}{10}$  of 9?  $\frac{1}{10}$  of 10?  $\frac{2}{10}$  of 10?  $\frac{3}{10}$  of 10?  $\frac{4}{10}$  of 10?  $\frac{5}{10}$  of 10?  $\frac{6}{10}$  of 10?  $\frac{7}{10}$  of 10?  $\frac{8}{10}$  of 10?  $\frac{9}{10}$  of 10?  $\frac{10}{10}$  of 10?

16. Which is the larger,  $\frac{1}{2}$  or  $\frac{1}{3}$ ?  $\frac{1}{8}$  or  $\frac{1}{11}$ ?  $\frac{1}{2}$  or  $\frac{1}{5}$ ?  
 $\frac{1}{2}$  or  $\frac{1}{10}$ ?  $\frac{1}{4}$  or  $\frac{1}{6}$ ?  $\frac{1}{4}$  or  $\frac{1}{20}$ ?  $\frac{1}{3}$  or  $\frac{1}{12}$ ?  $\frac{1}{10}$  or  $\frac{1}{15}$ ?

Such numbers as  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{2}{3}$ ,  $\frac{1}{4}$ , &c., are called *Fractions*. The number above the line is called the *numerator*, and the number below the line, the *denominator*.

XVIII.—1. Elizabeth wished to divide seven apples equally between Martha, Louisa and Mary. She gave them two apples apiece, and found she still had one left. How must she divide that one? Then how many apples did she give to each?

2. 7 are how many times 3? *Ans.* 2 times 3 and  $\frac{1}{3}$  of 3.

3. How much is  $\frac{1}{3}$  of 7? *Ans.*  $\frac{7}{3}$ , or 2 and  $\frac{1}{3}$ .

4. 8 are how many times 3? *Ans.* 2 times 3 and  $\frac{2}{3}$  of 3.

5. 9 are how many times 3? What is  $\frac{1}{3}$  of 9?

6. 10 are how many times 3? What is  $\frac{1}{3}$  of 10?

7. 11 are how many times 3? What is  $\frac{1}{3}$  of 11?

8. 12 are how many times 3? What is  $\frac{1}{3}$  of 12?

9. 13 are how many times 3? What is  $\frac{1}{3}$  of 13?

10. 14 are how many times 3? What is  $\frac{1}{3}$  of 14?

11. 15 are how many times 3? What is  $\frac{1}{3}$  of 15?

12. Silas promised to give four boys five apples, if either of them could tell how to divide them equally. How much ought each boy to receive?

13. 5 are how many times 4? What is  $\frac{1}{4}$  of 5?  
 $\frac{1}{4}$  are how many whole ones?

14. 6 are how many times 4? What is  $\frac{1}{4}$  of 6?  
 $\frac{1}{4}$  are how many whole ones?

15. 7 are how many times 4? What is  $\frac{1}{4}$  of 7?  
 $\frac{1}{4}$  are how many whole ones?

16. 8 are how many times 4? What is  $\frac{1}{2}$  of 8?  
 $\frac{1}{4}$  are how many whole ones?

17. 12 are how many times 4? What is  $\frac{1}{3}$  of 12?  
 $\frac{1}{4}$  are how many whole ones?

18. 16 are how many times 4? What is  $\frac{1}{4}$  of 16?  
 $\frac{1}{8}$  are how many whole ones?

19. 17 are how many times 4? What is  $\frac{1}{4}$  of 17?  
 $\frac{1}{7}$  are how many whole ones?

20. 19 are how many times 4? What is  $\frac{1}{4}$  of 19?  
 $\frac{1}{9}$  are how many whole ones?

21. If a yard of broadcloth costs five dollars, how much can be bought for six dollars?

22. 6 are how many times 5? What is  $\frac{1}{5}$  of 6?  $\frac{2}{5}$   
are how many whole ones?

23. 7 are how many times 5? What is  $\frac{1}{5}$  of 7?  $\frac{3}{5}$   
are how many whole ones?

24. 8 are how many times 5? What is  $\frac{1}{5}$  of 8?  $\frac{3}{5}$   
are how many whole ones?

25. 9 are how many times 5? What is  $\frac{1}{5}$  of 9?  $\frac{4}{5}$   
are how many whole ones?

26. 10 are how many times 5? What is  $\frac{1}{5}$  of 10?  
 $\frac{4}{5}$  are how many whole ones?

27. 11 are how many times 5? What is  $\frac{1}{5}$  of 11?  
 $\frac{6}{5}$  are how many whole ones?

28. 14 are how many times 5? What is  $\frac{1}{5}$  of 14?  
 $\frac{7}{5}$  are how many whole ones?

29. If a pair of shoes will last a man six months, how many pairs will last him seven months? How many 8 months? 12 months? 20 months?

30. 7 are how many times 6? What is  $\frac{1}{6}$  of 7?  $\frac{1}{3}$   
are how many whole ones?

31. 8 are how many times 6? What is  $\frac{1}{6}$  of 8?  $\frac{2}{3}$   
are how many whole ones?

32. 12 are how many times 6? What is  $\frac{1}{6}$  of 12?  
 $\frac{2}{3}$  are how many whole ones?

33. 18 are how many times 6? What is  $\frac{1}{6}$  of 18?  
 $\frac{1}{6}$  are how many whole ones?

34. 19 are how many times 6? What is  $\frac{1}{6}$  of 19?  
 $\frac{1}{6}$  are how many whole ones?

35. 20 are how many times 6? What is  $\frac{1}{6}$  of 20?  
 $\frac{1}{6}$  are how many whole ones?

36. 29 are how many times 6? What is  $\frac{1}{6}$  of 29?  
 $\frac{1}{6}$  are how many whole ones?

37. How many weeks are there in eight days? In  
9 days? 14 days? 17 days? 19 days? 20 days? 30  
days? 40 days? 50 days?

38. 8 are how many times 7? What is  $\frac{1}{7}$  of 8?  
 $\frac{1}{7}$  are how many whole ones?

39. 17 are how many times 7? What is  $\frac{1}{7}$  of 17?  
 $\frac{1}{7}$  are how many whole ones?

40. 20 are how many times 7? What is  $\frac{1}{7}$  of 20?  
 $\frac{1}{7}$  are how many whole ones?

41. 40 are how many times 7? What is  $\frac{1}{7}$  of 40?  
 $\frac{1}{7}$  are how many whole ones?

42. 50 are how many times 7? What is  $\frac{1}{7}$  of 50?  
 $\frac{1}{7}$  are how many whole ones?

43. If a quart of molasses costs nine cents, how  
many quarts can be bought for 11 cents? for 25 cents?  
for 36 cents? for 38 cents? for 44 cents?

44. 36 are how many times 9? What is  $\frac{1}{9}$  of 36?  
 $\frac{1}{9}$  are how many whole ones?

45. 44 are how many times 9? What is  $\frac{1}{9}$  of 44?  
 $\frac{1}{9}$  are how many whole ones?

46. How many dimes are there in 20 cents? In  
30 cents? In 32 cents? In 45 cents? In 47 cents?  
In 59 cents?

47. 47 are how many times 10? What is  $\frac{1}{10}$  of  
47?  $\frac{1}{10}$  are how many whole ones?

48. 59 are how many times 10? What is  $\frac{1}{10}$  of  
59?  $\frac{1}{10}$  are how many whole ones?

49. How many whole ones are there in  $\frac{1}{2}$ ? In  $\frac{3}{2}$ ?  
In  $\frac{5}{2}$ ? In  $\frac{7}{2}$ ? In  $\frac{9}{2}$ ? In  $\frac{11}{2}$ ? In  $\frac{13}{2}$ ? In  $\frac{15}{2}$ ?

XIX.—1. George had one-half of an apple, and Nathan gave him one-half more. How much had he then? how much are  $\frac{1}{2}$  and  $\frac{1}{2}$ ?

2. Eliza received one-third of a cake from her mother, and one third-from one of her playmates. How much had she then? how much are  $\frac{1}{3}$  and  $\frac{1}{3}$ ?

3. Thomas gave one-fourth of a dollar for a hand-kerchief, and two-fourths of a dollar for a pair of skates. How much did they both cost? how much are  $\frac{1}{4}$  and  $\frac{2}{4}$ ?

4. A grocer sells one-fifth of a barrel of flour to one man, and two-fifths to another. How much does he sell to both? how much are  $\frac{1}{5}$  and  $\frac{2}{5}$ ?

5. Charles gave two-sixths of an orange to his brother, and three-sixths to his sister. How much did he give away? how much are  $\frac{2}{6}$  and  $\frac{3}{6}$ ?

6. A merchant owning four-sevenths of a ship, bought two-sevenths more. What part did he then own? how much are  $\frac{4}{7}$  and  $\frac{2}{7}$ ?  $\frac{4}{7}$  and  $\frac{3}{7}$ ?  $\frac{4}{7}$  and  $\frac{4}{7}$ ?

7. A merchant owning six-sevenths of a ship, sold two-sevenths of it. What part did he then own? how much are  $\frac{6}{7}$  less  $\frac{2}{7}$ ?  $\frac{6}{7}$  less  $\frac{4}{7}$ ?

8. Jane ate three-eighths of an apple one day, and five-eighths the next day. How much did she eat in both days? how much are  $\frac{3}{8}$  and  $\frac{5}{8}$ ?  $\frac{3}{8}$  and  $\frac{7}{8}$ ?  $\frac{3}{8}$  and  $\frac{9}{8}$ ?

9. Jane ate three-eighths of an apple. What part of the apple was then left? how much are  $\frac{3}{8}$  less  $\frac{1}{8}$ ?  $1$  less  $\frac{3}{8}$ ?  $1$  less  $\frac{5}{8}$ ?  $\frac{1}{8}$  less  $\frac{3}{8}$ ?

10. James rode five-ninths of a mile, and walked two-ninths. How far did he go in the whole? how much are  $\frac{5}{9}$  and  $\frac{2}{9}$ ?  $\frac{5}{9}$  and  $\frac{4}{9}$ ?  $\frac{5}{9}$  and  $\frac{7}{9}$ ?

11. John went seven-ninths of a mile on an errand. He rode five-ninths of a mile, and walked the rest of the distance. How far did he walk?  $\frac{1}{9}$  from  $\frac{7}{9}$  leave how much?  $\frac{1}{9}$  from  $\frac{7}{9}$ ?  $\frac{1}{9}$  from  $\frac{8}{9}$  or 1?  $\frac{1}{9}$  from 1?

12. A grocer sold some sugar for three-tenths of a dollar, and some tea for four-tenths of a dollar. How much did he receive for both? how much are  $\frac{3}{10}$  and  $\frac{4}{10}$ ?  $\frac{3}{10}$  and  $\frac{6}{10}$ ?  $\frac{3}{10}$  and  $\frac{7}{10}$ ?  $\frac{4}{10}$  and  $\frac{6}{10}$ ?  $\frac{5}{10}$  and  $\frac{5}{10}$ ?  $\frac{4}{10}$  and  $\frac{5}{10}$ ?

13. A grocer received seven-tenths of a dollar, of which four-tenths were for tea, and the rest for sugar. How much did he receive for the sugar?  $\frac{4}{10}$  from  $\frac{7}{10}$  leave how many tenths?  $\frac{3}{10}$  from  $\frac{9}{10}$ ?  $\frac{7}{10}$  from 1?  $\frac{4}{10}$  from 1?  $\frac{2}{10}$  from 1?

14. How many tenths are seven-tenths and five-tenths?  $\frac{3}{10}$  and  $\frac{3}{10}$ ?  $\frac{6}{10}$  and  $\frac{9}{10}$ ?

15. What is the difference between  $\frac{5}{10}$  and  $\frac{7}{10}$ ?  $\frac{13}{10}$  and  $\frac{3}{10}$ ?  $\frac{9}{10}$  and  $\frac{4}{10}$ ?  $\frac{2}{10}$  and  $\frac{6}{10}$ ?

16. How many elevenths are three-elevenths and eight elevenths?  $\frac{2}{11}$  and  $\frac{9}{11}$ ?  $\frac{7}{11}$  and  $\frac{5}{11}$ ?  $\frac{4}{11}$  and  $\frac{11}{11}$ ?  $\frac{3}{11}$  and  $\frac{12}{11}$ ?  $\frac{5}{11}$  and  $\frac{5}{11}$ ?

17.  $\frac{2}{11}$  from 1 leave how many elevenths?  $\frac{8}{11}$  from  $\frac{9}{11}$ ?  $\frac{4}{11}$  from  $\frac{5}{11}$ ?  $\frac{10}{11}$  from  $\frac{11}{11}$ ?  $\frac{6}{11}$  from  $\frac{12}{11}$ ?

XX.—1. William divided an apple into two equal parts, and afterwards divided each of those parts into two parts. Into how many pieces was the apple then divided? What would one of those parts be called? How much is  $\frac{1}{2}$  of  $\frac{1}{2}$ ?

2. If an orange were divided into three pieces, and each of those pieces divided into two pieces, how many pieces would there be to the orange? What would one of those pieces be called? What is  $\frac{1}{2}$  of  $\frac{1}{3}$ ?

3. If I cut an apple into quarters, and then halve each quarter, how many pieces will there be to the apple? What will one piece be called? What is  $\frac{1}{2}$  of  $\frac{1}{4}$ ?

4. Ellen cut a cake into five equal parts, and then cut each part in two. How many pieces had she? What would one piece be called? What is  $\frac{1}{2}$  of  $\frac{1}{5}$ ?  $\frac{1}{2}$  of  $\frac{2}{5}$ ?

5. If you divide half an apple into three equal parts, what part of the whole apple will each piece be? What is  $\frac{1}{3}$  of  $\frac{1}{2}$ ?  $\frac{2}{3}$  of  $\frac{1}{2}$ ?

6. A family use one-third of a barrel of flour in three weeks. What part of a barrel will they use in one week? What is  $\frac{1}{3}$  of  $\frac{1}{3}$ ?  $\frac{1}{3}$  of  $\frac{2}{3}$ ?  $\frac{2}{3}$  of  $\frac{1}{3}$ ?

7. If a horse eats one-fourth of a bushel of oats in three days, how long will it take him to eat a bushel? Then what part of a bushel will he eat in one day? What is  $\frac{1}{3}$  of  $\frac{1}{4}$ ?  $\frac{1}{3}$  of  $\frac{2}{4}$ ?  $\frac{1}{3}$  of  $\frac{3}{4}$ ?  $\frac{1}{3}$  of  $\frac{4}{4}$ ?

8. If a man walks one-fifth of a mile in three minutes, how long will it take him to walk a mile? What part of a mile will he walk in one minute? What is  $\frac{1}{3}$  of  $\frac{1}{5}$ ?  $\frac{1}{3}$  of  $\frac{2}{5}$ ?  $\frac{1}{3}$  of  $\frac{3}{5}$ ?  $\frac{1}{3}$  of  $\frac{4}{5}$ ?  $\frac{1}{3}$  of  $\frac{5}{5}$ ?

9. If I cut an apple into quarters, and cut each quarter into quarters, how many pieces shall I have? What will one of the pieces be called? What is  $\frac{1}{4}$  of  $\frac{1}{4}$ ?  $\frac{1}{4}$  of  $\frac{2}{4}$ ?  $\frac{1}{4}$  of  $\frac{3}{4}$ ?  $\frac{1}{4}$  of  $\frac{4}{4}$ ?

10. How much is one-fifth of twenty cents?  $\frac{1}{5}$  of  $\frac{1}{2}$  of 20 cents? What part of 20 cents is 1 cent? Then what is  $\frac{1}{5}$  of  $\frac{1}{5}$ ?  $\frac{1}{5}$  of  $\frac{2}{5}$ ?  $\frac{1}{5}$  of  $\frac{3}{5}$ ?  $\frac{1}{5}$  of  $\frac{4}{5}$ ?  $\frac{1}{5}$  of  $\frac{5}{5}$ ?

11. What is  $\frac{1}{5}$  of  $\frac{1}{5}$ ?  $\frac{1}{5}$  of  $\frac{2}{5}$ ?  $\frac{1}{5}$  of  $\frac{3}{5}$ ?  $\frac{1}{5}$  of  $\frac{4}{5}$ ?  $\frac{1}{5}$  of  $\frac{5}{5}$ ?  $\frac{2}{5}$  of  $\frac{1}{5}$ ?  $\frac{2}{5}$  of  $\frac{2}{5}$ ?  $\frac{2}{5}$  of  $\frac{3}{5}$ ?  $\frac{2}{5}$  of  $\frac{4}{5}$ ?  $\frac{2}{5}$  of  $\frac{5}{5}$ ?

12. What is  $\frac{1}{5}$  of  $\frac{1}{6}$ ?  $\frac{1}{5}$  of  $\frac{2}{6}$ ?  $\frac{1}{5}$  of  $\frac{3}{6}$ ?  $\frac{1}{5}$  of  $\frac{4}{6}$ ?  $\frac{1}{5}$  of  $\frac{5}{6}$ ?  $\frac{1}{5}$  of  $\frac{6}{6}$ ?

13. What is  $\frac{1}{2}$  of 2?  $\frac{1}{2}$  of  $\frac{1}{3}$ ?  $\frac{1}{2}$  of  $\frac{2}{3}$ ?  $\frac{1}{2}$  of  $\frac{3}{3}$ ?  $\frac{1}{2}$  of  $\frac{4}{3}$ ?

14. What is  $\frac{1}{2}$  of 4?  $\frac{1}{2}$  of  $\frac{4}{3}$ ?  $\frac{1}{2}$  of  $\frac{4}{7}$ ?  $\frac{1}{2}$  of  $\frac{4}{9}$ ?  $\frac{1}{2}$  of  $\frac{4}{11}$ ?

15. What is  $\frac{1}{3}$  of 3?  $\frac{1}{3}$  of  $\frac{3}{2}$ ?  $\frac{1}{3}$  of  $\frac{3}{4}$ ?  $\frac{1}{3}$  of  $\frac{3}{5}$ ?  $\frac{1}{3}$  of  $\frac{3}{7}$ ?

16. What is  $\frac{1}{4}$  of 6?  $\frac{1}{4}$  of  $\frac{6}{3}$ ?  $\frac{1}{4}$  of  $\frac{6}{4}$ ?  $\frac{1}{4}$  of  $\frac{6}{5}$ ?  $\frac{1}{4}$  of  $\frac{6}{7}$ ?

17. What is  $\frac{1}{4}$  of 4?  $\frac{1}{4}$  of  $\frac{4}{3}$ ?  $\frac{1}{4}$  of  $\frac{4}{7}$ ?  $\frac{1}{4}$  of  $\frac{4}{9}$ ?  $\frac{1}{4}$  of  $\frac{4}{11}$ ?

18. What is  $\frac{2}{3}$  of 4?  $\frac{2}{3}$  of  $\frac{4}{3}$ ?  $\frac{2}{3}$  of  $\frac{4}{7}$ ?  $\frac{2}{3}$  of  $\frac{4}{9}$ ?  $\frac{2}{3}$  of  $\frac{4}{11}$ ?

19. What is  $\frac{2}{3}$  of 4?  $\frac{2}{3}$  of  $\frac{4}{5}$ ?  $\frac{2}{3}$  of  $\frac{4}{7}$ ?  $\frac{2}{3}$  of  $\frac{4}{9}$ ?  $\frac{2}{3}$  of  $\frac{4}{11}$ ?

20. What is  $\frac{1}{5}$  of 5?  $\frac{1}{5}$  of  $\frac{5}{2}$ ?  $\frac{1}{5}$  of  $\frac{5}{7}$ ?  $\frac{1}{5}$  of  $\frac{5}{9}$ ?  $\frac{1}{5}$  of  $\frac{5}{11}$ ?

21. What is  $\frac{2}{5}$  of 5?  $\frac{2}{5}$  of  $\frac{5}{2}$ ?  $\frac{2}{5}$  of  $\frac{5}{7}$ ?  $\frac{2}{5}$  of  $\frac{5}{9}$ ?  $\frac{2}{5}$  of  $\frac{5}{11}$ ?

22. What is  $\frac{3}{5}$  of 5?  $\frac{3}{5}$  of  $\frac{5}{2}$ ?  $\frac{3}{5}$  of  $\frac{5}{7}$ ?  $\frac{3}{5}$  of  $\frac{5}{9}$ ?  $\frac{3}{5}$  of  $\frac{5}{11}$ ?

23. What is  $\frac{4}{5}$  of 5?  $\frac{4}{5}$  of  $\frac{5}{2}$ ?  $\frac{4}{5}$  of  $\frac{5}{7}$ ?  $\frac{4}{5}$  of  $\frac{5}{9}$ ?  $\frac{4}{5}$  of  $\frac{5}{11}$ ?

24. What is  $\frac{1}{6}$  of 6?  $\frac{1}{6}$  of  $\frac{6}{5}$ ?  $\frac{1}{6}$  of  $\frac{6}{7}$ ?  $\frac{1}{6}$  of  $\frac{6}{9}$ ?  $\frac{1}{6}$  of  $\frac{6}{11}$ ?

25. What is  $\frac{2}{6}$  of 6?  $\frac{2}{6}$  of  $\frac{6}{5}$ ?  $\frac{2}{6}$  of  $\frac{6}{7}$ ?  $\frac{2}{6}$  of  $\frac{6}{9}$ ?  $\frac{2}{6}$  of  $\frac{6}{11}$ ?

26. What is  $\frac{3}{6}$  of 6?  $\frac{3}{6}$  of  $\frac{6}{5}$ ?  $\frac{3}{6}$  of  $\frac{6}{7}$ ?  $\frac{3}{6}$  of  $\frac{6}{9}$ ?  $\frac{3}{6}$  of  $\frac{6}{11}$ ?

27. What is  $\frac{4}{6}$  of 6?  $\frac{4}{6}$  of  $\frac{6}{5}$ ?  $\frac{4}{6}$  of  $\frac{6}{7}$ ?  $\frac{4}{6}$  of  $\frac{6}{9}$ ?  $\frac{4}{6}$  of  $\frac{6}{11}$ ?

28. What is  $\frac{5}{6}$  of 6?  $\frac{5}{6}$  of  $\frac{6}{5}$ ?  $\frac{5}{6}$  of  $\frac{6}{7}$ ?  $\frac{5}{6}$  of  $\frac{6}{9}$ ?  $\frac{5}{6}$  of  $\frac{6}{11}$ ?

29. What is  $\frac{1}{10}$  of 10?  $\frac{1}{10}$  of  $\frac{10}{11}$ ?  $\frac{1}{10}$  of  $\frac{10}{13}$ ?  $\frac{1}{10}$  of  $\frac{10}{17}$ ?  $\frac{1}{10}$  of  $\frac{10}{19}$ ?  $\frac{1}{10}$  of  $\frac{10}{21}$ ?

30. What is  $\frac{3}{10}$  of 10?  $\frac{3}{10}$  of  $\frac{10}{11}$ ?  $\frac{3}{10}$  of  $\frac{10}{13}$ ?  $\frac{3}{10}$  of  $\frac{10}{17}$ ?  $\frac{3}{10}$  of  $\frac{10}{19}$ ?  $\frac{3}{10}$  of  $\frac{10}{21}$ ?

31. What is  $\frac{7}{15}$  of 10?  $\frac{7}{15}$  of  $\frac{10}{11}$ ?  $\frac{7}{15}$  of  $\frac{10}{13}$ ?  $\frac{7}{15}$  of  $\frac{10}{17}$ ?  $\frac{7}{15}$  of  $\frac{10}{19}$ ?  $\frac{7}{15}$  of  $\frac{10}{21}$ ?

32. What is  $\frac{9}{15}$  of 10?  $\frac{9}{15}$  of  $\frac{10}{11}$ ?  $\frac{9}{15}$  of  $\frac{10}{13}$ ?  $\frac{9}{15}$  of  $\frac{10}{17}$ ?  $\frac{9}{15}$  of  $\frac{10}{19}$ ?  $\frac{9}{15}$  of  $\frac{10}{21}$ ?

Fractions of fractions, such as  $\frac{1}{2}$  of  $\frac{1}{4}$ ;  $\frac{1}{4}$  of  $\frac{1}{5}$ , &c., are called *Compound Fractions*.

**XXI.—1.** Ten tenths make a whole one; then how many tenths are there in  $\frac{1}{2}$ ? What is  $\frac{1}{2}$  of 10?

2. What is  $\frac{1}{5}$  of 10? How many tenths are there in  $\frac{1}{2}$ ?  $\frac{2}{5}$ ?  $\frac{3}{5}$ ?  $\frac{4}{5}$ ?

3. What is  $\frac{1}{2}$  of 4? How many fourths are there in  $\frac{1}{2}$ ? How many sixths?

4.  $\frac{1}{2}$  is how many eighths? twelfths? twentieths? hundredths?

5.  $\frac{1}{2}$  is how many sixths? ninths? twelfths? fifteenths? forty-fifths?

6.  $\frac{1}{2}$  is how many eighths? twelfths? sixteenths? twentieths? fortieths?

7.  $\frac{1}{2}$  is how many tenths? fifteenths? twentieths? twenty-fifths? fiftieths?

8.  $\frac{1}{2}$  is how many twelfths? eighteenths? twenty-fourths? sixtieths?

9.  $\frac{1}{2}$  is how many fourteenths? twenty-eighths? thirty-fifths? seventieths?

10.  $\frac{1}{2}$  is how many sixteenths? twenty-fourths? fortieths? eightyths?

11.  $\frac{1}{2}$  is how many eighteenths? forty-fifths? sixty-thirds? ninetieths?

12.  $\frac{1}{2}$  is how many twentieths? thirtieths? fiftieths? hundredths?

13. How many sixths are there in  $\frac{1}{2}$ ?  $\frac{3}{4}$ ?  $\frac{5}{6}$ ?

14. How many eighths are there in  $\frac{1}{2}$ ?  $\frac{3}{4}$ ?  $\frac{5}{6}$ ?  $\frac{7}{8}$ ?

15. How many twelfths are there in  $\frac{1}{2}$ ?  $\frac{3}{4}$ ?  $\frac{5}{6}$ ?  $\frac{7}{8}$ ?  
 $\frac{9}{10}$ ?  $\frac{11}{12}$ ?  $\frac{13}{14}$ ?  $\frac{15}{16}$ ?

16. How many fourteenths are there in  $\frac{1}{2}$ ?  $\frac{3}{4}$ ?  
 $\frac{5}{6}$ ?  $\frac{7}{8}$ ?

17. How many sixteenths are there in  $\frac{1}{2}$ ?  $\frac{3}{4}$ ?  $\frac{5}{6}$ ?  
 $\frac{7}{8}$ ?  $\frac{9}{10}$ ?  $\frac{11}{12}$ ?  $\frac{13}{14}$ ?

18. How many eighteenths are there in  $\frac{1}{2}$ ?  $\frac{3}{4}$ ?  $\frac{5}{6}$ ?  
 $\frac{7}{8}$ ?  $\frac{9}{10}$ ?  $\frac{11}{12}$ ?  $\frac{13}{14}$ ?

19. How many twentieths are there in  $\frac{1}{2}$ ?  $\frac{1}{10}$ ?  $\frac{7}{10}$ ?  
 $\frac{9}{10}$ ?  $\frac{1}{4}$ ?  $\frac{1}{5}$ ?  $\frac{3}{4}$ ?  $\frac{3}{5}$ ?  $\frac{7}{8}$ ?

20. How many sixtieths are there in  $\frac{1}{2}$ ?  $\frac{3}{4}$ ?  $\frac{5}{6}$ ?  $\frac{7}{8}$ ?  
 $\frac{1}{10}$ ?  $\frac{1}{15}$ ?  $\frac{1}{20}$ ?  $\frac{1}{30}$ ?  $\frac{1}{40}$ ?

21. How many hundredths are there in  $\frac{1}{2}$ ?  $\frac{1}{4}$ ?  $\frac{3}{4}$ ?  
 $\frac{1}{5}$ ?  $\frac{1}{3}$ ?  $\frac{2}{3}$ ?  $\frac{3}{5}$ ?  $\frac{1}{10}$ ?  $\frac{3}{10}$ ?  $\frac{7}{10}$ ?  $\frac{9}{10}$ ?

XXII.—1. If one yard of silk costs two dollars, what will half a yard cost? 1 yard and  $\frac{1}{2}$ ? 2 yards and  $\frac{1}{2}$ ? What is  $\frac{1}{2}$  of 2?  $1\frac{1}{2}$  times 2?  $2\frac{1}{2}$  times 2?

2. If one yard of silk costs two dollars and a half, what will two yards cost? What is 2 times 2? 2 times  $\frac{1}{2}$ ? 2 times 2 and 2 times  $\frac{1}{2}$ ? 2 times  $2\frac{1}{2}$ ?

3. If one yard of cassimere costs three dollars, what will one-third of a yard cost?  $\frac{1}{3}$  of a yard? 1 yard and  $\frac{1}{3}$ ? 2 yards and  $\frac{1}{3}$ ? 3 yards and  $\frac{1}{3}$ ? What is  $\frac{1}{3}$  of 3?  $\frac{1}{3}$  of 3?  $1\frac{1}{3}$  times 3?  $2\frac{1}{3}$  times 3?  $3\frac{1}{3}$  times 3?

4. 3 times  $\frac{1}{2}$  are how many whole ones? 3 times  $\frac{1}{2}$ ? 3 times 1 and 3 times  $\frac{1}{2}$ ? 3 times  $2\frac{1}{2}$ ? 3 times  $3\frac{1}{2}$ ? 3 times  $4\frac{1}{2}$ ?

5. How much must I give for three barrels of apples, at one and two-thirds dollars a barrel? How much at  $2\frac{1}{3}$  dollars? At  $3\frac{1}{3}$  dollars?

6. If a labourer receives four dollars a week, how much will he receive for one-fourth of a week? How much for  $\frac{1}{4}$ ? for  $1\frac{1}{4}$ ?  $2\frac{1}{4}$ ?  $3\frac{1}{4}$ ?  $4\frac{1}{4}$ ? What is  $\frac{1}{4}$  of 4?  $\frac{1}{4}$  of 4?  $1\frac{1}{4}$  times 4?  $2\frac{1}{4}$  times 4?  $3\frac{1}{4}$  times 4?  $4\frac{1}{4}$  times 4?

7. 4 times  $\frac{1}{2}$  are how many whole ones? 4 times  $\frac{3}{2}$ ?  
4 times  $1\frac{1}{2}$ ? 4 times  $2\frac{1}{2}$ ? 4 times  $3\frac{1}{2}$ ? 4 times  $4\frac{1}{2}$ ?

8. What will four barrels of flour cost, at four and three-fourths dollars a barrel? at  $3\frac{3}{4}$  dollars? at  $5\frac{1}{2}$  dollars?

9. What is two-fifths of five?  $\frac{3}{5}$  of 5?  $1\frac{1}{5}$  times 5?  
 $2\frac{2}{5}$  times 5?  $3\frac{2}{5}$  times 5?

10. What is 5 times  $\frac{1}{2}$ ? 5 times  $\frac{3}{2}$ ? 5 times  $1\frac{1}{2}$ ? 5 times  $2\frac{1}{2}$ ? 5 times  $3\frac{1}{2}$ ?

11. At six dollars a yard, what will be the cost of three and one-sixth yards? Of  $4\frac{1}{6}$  yards?  $5\frac{1}{6}$  yards?  $7\frac{1}{6}$  yards?

12. What is 6 times  $3\frac{1}{8}$ ? 6 times  $4\frac{5}{8}$ ? 6 times  $5\frac{5}{8}$ ?  
6 times  $7\frac{1}{8}$ ?

13. How many days are there in one and five-sevenths weeks? In  $2\frac{3}{7}$ ?  $3\frac{3}{7}$ ?  $4\frac{4}{7}$ ?  $7\frac{1}{7}$ ? How much are 7 times  $1\frac{1}{7}$ ? 7 times  $2\frac{3}{7}$ ? 7 times  $3\frac{2}{7}$ ? 7 times  $4\frac{5}{7}$ ?  
7 times  $7\frac{1}{7}$ ?

14. At eight dollars a barrel, what will seven and six-eighths barrels of flour cost? What are  $7\frac{6}{8}$  times 8? 8 times  $7\frac{6}{8}$ ?

15. At nine dollars a month, what will be a labourer's wages for seven and seven-ninths months? What are  $7\frac{7}{9}$  times 9? 9 times  $7\frac{7}{9}$ ?

16. If a ship sails ten miles an hour, how far will she sail in six and three-tenths hours? What are  $6\frac{3}{10}$  times 10? 10 times  $6\frac{3}{10}$ ? 10 times  $7\frac{5}{10}$ ? 10 times  $9\frac{6}{10}$ ?

**XXIII.—1.** Since  $\frac{2}{2}$  make 1, how many halves are there in 2?  $2\frac{1}{2}$ ? 3?  $3\frac{1}{2}$ ? 4?  $4\frac{1}{2}$ ? 5?

2. How many thirds in 2?  $2\frac{1}{3}$ ?  $2\frac{2}{3}$ ? 3?  $3\frac{1}{3}$ ?  $3\frac{2}{3}$ ? 4?  $4\frac{1}{3}$ ?  $4\frac{2}{3}$ ? 5?

3. How many fourths in 2?  $2\frac{1}{4}$ ?  $2\frac{2}{4}$ ?  $2\frac{3}{4}$ ? 3?  $3\frac{1}{4}$ ?  $3\frac{2}{4}$ ?  $3\frac{3}{4}$ ? 4?  $4\frac{1}{4}$ ? 5?

4. How many fifths in  $2\frac{1}{5}$ ?  $2\frac{1}{5}$ ?  $2\frac{1}{5}$ ?  $3\frac{1}{5}$ ?  $3\frac{2}{5}$ ?  $4\frac{2}{5}$ ?  $5\frac{1}{5}$ ?  $7\frac{1}{5}$ ?
5. Change or reduce 2 to sixths;  $2\frac{1}{6}$ ;  $2\frac{2}{6}$ ;  $2\frac{3}{6}$ ;  $2\frac{4}{6}$ ;  $3\frac{1}{6}$ ;  $6\frac{1}{6}$ .
6. Reduce 2 to sevenths;  $2\frac{1}{7}$ ;  $3$ ;  $3\frac{2}{7}$ ;  $4\frac{1}{7}$ ;  $4\frac{3}{7}$ ;  $4\frac{4}{7}$ ;  $5\frac{1}{7}$ ;  $6$ ;  $7\frac{3}{7}$ .
7. Reduce 2 to eighths;  $2\frac{1}{8}$ ;  $2\frac{2}{8}$ ;  $2\frac{3}{8}$ ;  $2\frac{4}{8}$ ;  $3$ ;  $4$ ;  $5\frac{1}{8}$ ;  $7\frac{1}{8}$ .
8. Reduce 2 to ninths;  $3$ ;  $4$ ;  $5$ ;  $5\frac{1}{9}$ ;  $5\frac{2}{9}$ ;  $6\frac{3}{9}$ ;  $7\frac{3}{9}$ .
9. Reduce 2 to tenths;  $2\frac{5}{10}$ ?  $2\frac{7}{10}$ ;  $2\frac{9}{10}$ ;  $3\frac{4}{10}$ ;  $4\frac{3}{10}$ ;  $5\frac{4}{10}$ ;  $6\frac{9}{10}$ .
10. Reduce  $9\frac{1}{2}$  to eighths;  $10\frac{1}{2}$  to fifths;  $12\frac{1}{2}$  to halves;  $11\frac{1}{2}$  to thirds;  $8\frac{1}{2}$  to fourths; 8 to sevenths;  $7\frac{1}{2}$  to sixths;  $9\frac{1}{2}$  to sevenths; 12 to fifths;  $9\frac{1}{2}$  to ninths;  $7\frac{9}{10}$  to tenths.

XXIV.—1. How many times is  $\frac{1}{2}$  contained in  $1\frac{1}{2}$ ? In  $2\frac{1}{2}$ ? Then what is 1 divided by  $\frac{1}{2}$ ? 2 divided by  $\frac{1}{2}$ ?

2. How many times is  $\frac{1}{3}$  contained in  $1\frac{1}{3}$ ? In  $2\frac{1}{3}$ ? In  $3\frac{1}{3}$ ? What is 1 divided by  $\frac{1}{3}$ ? 2 divided by  $\frac{1}{3}$ ? 3 divided by  $\frac{1}{3}$ ?

3. How many times  $\frac{1}{4}$  in  $1\frac{1}{4}$ ? In  $1\frac{3}{4}$ ? In  $2\frac{1}{4}$ ? What is 1 divided by  $\frac{1}{4}$ ?  $1\frac{1}{4}$  divided by  $\frac{1}{4}$ ?  $1\frac{3}{4}$  divided by  $\frac{1}{4}$ ?  $2\frac{1}{4}$  divided by  $\frac{1}{4}$ ?

4. Divide by  $\frac{1}{5}$ , each of the following numbers. 1,  $2$ ,  $3\frac{1}{5}$ ,  $4\frac{2}{5}$ ,  $5$ ,  $6\frac{1}{5}$ ,  $7$ ,  $7\frac{1}{5}$ ,  $7\frac{2}{5}$ ,  $8$ ,  $8\frac{1}{5}$ .

5. Divide each of the following numbers by  $\frac{1}{6}$ .  $1\frac{1}{6}$ ,  $2\frac{3}{6}$ ,  $3\frac{5}{6}$ ,  $4$ ,  $5\frac{1}{6}$ ,  $6\frac{1}{6}$ ,  $6\frac{5}{6}$ ,  $7$ .

6. Divide each of the following numbers by  $\frac{1}{7}$ . 4,  $2\frac{2}{7}$ ,  $1\frac{1}{7}$ ,  $3\frac{5}{7}$ ,  $8$ ,  $9\frac{3}{7}$ ,  $7\frac{4}{7}$ ,  $5$ ,  $6\frac{1}{7}$ .

7. Divide each of the following numbers by  $\frac{1}{8}$ .  $6\frac{1}{8}$ ,  $4\frac{4}{8}$ ,  $1\frac{1}{8}$ ,  $5\frac{4}{8}$ ,  $2\frac{4}{8}$ ,  $3$ ,  $7\frac{1}{8}$ .

8. Divide each of the following numbers by  $\frac{1}{9}$ .  $9$ ,  $8\frac{1}{9}$ ,  $7\frac{2}{9}$ ,  $6\frac{8}{9}$ ,  $5\frac{4}{9}$ ,  $4$ ,  $3\frac{5}{9}$ ,  $2\frac{7}{9}$ .

9. How many times does 3 contain  $\frac{1}{10}$ ?  $\frac{2}{10}$ ?  $\frac{3}{10}$ ?  $\frac{4}{10}$ ?  $\frac{5}{10}$ ? Then what is 3 divided by  $\frac{1}{10}$ ? By  $\frac{2}{10}$ ?  $\frac{3}{10}$ ?  $\frac{4}{10}$ ?  $\frac{5}{10}$ ?

10. 6 is how many times  $\frac{1}{4}$ ?  $\frac{2}{4}$ ?  $\frac{3}{4}$ ?  $\frac{4}{4}$ ? Divide 6 by  $\frac{1}{4}$ ;  $\frac{2}{4}$ ;  $\frac{3}{4}$ ;  $\frac{4}{4}$ .

11. Divide 2 by  $\frac{2}{3}$ ;  $\frac{1}{2}$ ;  $\frac{2}{5}$ ;  $\frac{4}{5}$ .

12. Divide  $\frac{1}{2}$  by  $\frac{1}{4}$ ;  $\frac{1}{3}$ ;  $\frac{1}{2}$ ;  $\frac{1}{5}$ ;  $\frac{1}{2}$ ;  $\frac{2}{5}$ ;  $\frac{3}{5}$ .

13. Divide  $1\frac{1}{2}$  by  $\frac{1}{2}$ ;  $\frac{1}{3}$ ;  $\frac{1}{4}$ ;  $\frac{2}{3}$ .

14. Divide  $5\frac{3}{4}$  by  $\frac{1}{4}$ ;  $\frac{1}{3}$ ;  $\frac{1}{2}$ ;  $\frac{2}{3}$ .

15. Divide  $6\frac{2}{3}$  by  $\frac{1}{2}$ ;  $\frac{2}{3}$ ;  $\frac{1}{3}$ ;  $\frac{1}{10}$ ;  $\frac{4}{10}$ ;  $\frac{9}{10}$ ;  $\frac{1}{8}$ ;  $\frac{4}{8}$ ;  $\frac{1}{5}$ ;  $\frac{4}{5}$ .

16. Divide  $4\frac{1}{3}$  by  $\frac{1}{2}$ ;  $\frac{3}{5}$ ;  $\frac{9}{10}$ ;  $2\frac{3}{10}$ .

17. Divide  $7\frac{1}{2}$  by  $\frac{1}{6}$ ;  $\frac{3}{8}$ ;  $2\frac{3}{5}$ .

18. Divide  $9\frac{1}{2}$  by  $2\frac{1}{2}$ ;  $4\frac{1}{2}$ ;  $2\frac{2}{3}$ ;  $1\frac{5}{6}$ ;  $2\frac{4}{12}$ .

19. How much is 1 divided by 2? [See Section XVII.]  $\frac{1}{2}$  by  $\frac{2}{3}$ ?  $\frac{1}{2}$  by  $\frac{3}{4}$ ?  $\frac{1}{2}$  by  $\frac{4}{5}$ ?  $\frac{1}{2}$  by  $\frac{5}{6}$ ?

20. How much is 3 divided by 4?  $\frac{3}{4}$  by  $\frac{1}{2}$ ?  $\frac{3}{4}$  by  $\frac{3}{4}$ ?  $\frac{3}{4}$  by  $\frac{1}{2}$ ?

21. How much is 9 divided by 11?  $\frac{9}{11}$  by  $\frac{11}{9}$ ?  $2\frac{1}{2}$ ,  $(\frac{5}{2})$  by  $2\frac{3}{4}$ ,  $(\frac{11}{4})$ ?  $1\frac{1}{2}$  by  $2\frac{1}{5}$ ?

22. How much is  $\frac{1}{2}$  divided by  $\frac{1}{2}$ ,  $(\frac{2}{2})$ ?  $\frac{1}{2}$  by  $\frac{1}{2}$ ?  $1\frac{1}{2}$  by  $1\frac{1}{2}$ ?  $4\frac{1}{2}$  by  $9\frac{1}{2}$ ?

23. Divide  $\frac{1}{2}$  by  $\frac{1}{2}$ ,  $(\frac{3}{2})$ ;  $\frac{2}{3}$  by  $\frac{1}{2}$ ;  $1\frac{1}{2}$  by  $2\frac{1}{2}$ .

24. Divide  $\frac{1}{2}$  by  $\frac{1}{2}$ ,  $(\frac{2}{3})$ ;  $\frac{2}{3}$  by  $\frac{1}{2}$ ;  $2\frac{1}{2}$  by  $3\frac{1}{2}$ .

25. Divide  $\frac{1}{2}$  by  $\frac{2}{3}$ ,  $(\frac{4}{3})$ ;  $\frac{2}{3}$  by  $\frac{2}{3}$ ;  $1\frac{1}{2}$  by  $1\frac{1}{2}$ .

26. Divide  $\frac{2}{3}$  by  $\frac{2}{3}$ ,  $(\frac{6}{3})$ ;  $\frac{4}{3}$  by  $2\frac{2}{3}$ ;  $3\frac{2}{3}$  by  $4\frac{2}{3}$ .

27. Divide  $\frac{3}{10}$  by  $\frac{4}{5}$ ,  $(\frac{8}{10})$ ;  $1\frac{2}{10}$  by  $1\frac{4}{5}$ ;  $2\frac{7}{10}$  by  $3\frac{4}{5}$ .

28. Divide  $1\frac{1}{2}$  by 2;  $2\frac{1}{2}$  by  $3\frac{1}{2}$ ;  $2\frac{2}{3}$  by  $4\frac{2}{3}$ ;  $6\frac{1}{2}$  by  $7\frac{1}{2}$ .

29. Divide  $2\frac{1}{2}$  by  $4\frac{1}{2}$ ;  $1\frac{1}{2}$  by  $2\frac{2}{3}$ ;  $\frac{2}{3}$  by  $7\frac{1}{2}$ .

30. Divide  $4\frac{1}{2}$  by  $6\frac{1}{4}$ ;  $9\frac{1}{4}$  by  $10$ ;  $3\frac{2}{10}$  by  $4\frac{3}{10}$ .

# WRITTEN ARITHMETIC.

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## CHAPTER I.

### NUMERATION.

We have already seen, that by placing a 0 at the right hand of any figure, we make it represent a number ten times as large. Thus, 10 (ten) is ten times 1; 20 (2 tens or twenty) is ten times 2; 100 (10 tens or one hundred) is ten times 10; 300 (30 tens or three hundred) is ten times 30; 1000 (ten hundreds or one thousand) is ten times 100;—and so on.

Then, if the right hand figure in any number represents units, the second figure will represent tens, the third hundreds, the fourth thousands, &c., as in the following table:

Hundred millions.	
Ten millions.	
MILLIONS.	
Hundred thousands.	
Ten thousands.	
Thousands.	
Hundreds.	
Tens.	
Units.	
5	6
3	2
7	9
5	4
1	

This number is read, Five hundred and sixty-three millions, two hundred and seventy-nine thousand, five hundred and forty-one.

If we place figures at the right of units, we can denote tenths, hundredths, &c., as in the following table. The numbers so written are called DECIMALS; and to distinguish them from whole numbers, they are separated from units by a dot, called the *Decimal Point*, or *Separatrix*.

<b>5</b>	<b>Hundred millions.</b>
<b>6</b>	<b>Ten millions.</b>
<b>7</b>	<b>Hundred thousands.</b>
<b>8</b>	<b>Ten thousands.</b>
<b>9</b>	<b>Thousands.</b>
<b>0</b>	<b>Hundreds.</b>
<b>1</b>	<b>Tens.</b>
<b>2</b>	<b>Units.</b>
<b>3</b>	<b>Tenths.</b>
<b>4</b>	<b>Hundredths.</b>
<b>5</b>	<b>Thousands.</b>
<b>6</b>	<b>Ten thousandths.</b>
<b>7</b>	<b>Hundred thousandths.</b>
<b>8</b>	<b>Millionths.</b>
<b>9</b>	<b>Ten millionths.</b>
<b>0</b>	<b>Hundred millionths.</b>

The above number is read, Five hundred and sixty-three million, two hundred and seventy-nine thousand, five hundred and forty-one—and forty-five million, nine hundred and seventy-two thousand, three hundred and sixty-five *hundred millionths*.

The character 0, as its name denotes, has no value by itself, but is employed when there are none of the denomination whose place it occupies. Thus, in 106 there are 0 tens; in .004 there are no tenths or hundredths. On this account, 0s at the right of decimals or at the left of whole numbers, do not affect their value.

**Examples to be Read and Explained by the Teacher on the Board.**

**2,005,016.0003006** | **201,897.049003**

Teach the pupil to place a comma at each third figure to the right and to the left of the decimal point, as in the example below. Then the first period of integers will represent units; the second thousands; the third millions, &c. The first decimal period will represent thousandths; the second millionths, &c. He may also commence with the right hand decimal

figure, and place a supplementary comma above each third figure to the left. He will then soon perceive that

97,000,006.01'3,70'6,95

is read, Ninety-seven million and six,—and one million, three hundred and seventy thousand, six hundred and ninety-five, *hundred millionths*.

*Examples to be Written on the Slate, and Read by the Pupil.*

1. 716	21. 17400290.6
2. 20.7	22. 17400.2906
3. ,104.31	23. 174.002906
4. 3000.08	24. 20.070011
5. 4005.016	25. .0084009
6. 6012.0384	26. 7060.0607
7. 7906.10085	27. 990880.088099
8. 20000.0000059	28. 3704.00046
9. 40800.1000083	29. 1987.26543
10. 76005.4300021	30. 7750.0775
11. .99071304	31. 63078041.06307
12. .00010001	32. 112203.00112203
13. 999.99999	33. 800000604.9
14. 400016,640029	34. 98.00000604
15. 33.0598	35. 3.00000003
16. 33.00598	36. .00005008
17. 84017.0309	37. 1000.001
18. 84.0170309	38. 290017.010628
19. 8401703.09	39. 843034.2008011
20. 174002906	40. 1770028.1844
	41. 998800077.00600054
	42. 300000002.00011009

43. Repeat the Numeration Table, for whole numbers and decimals.

*Examples to be Written and Explained by the Teacher on the Board.*

Twenty-nine million and sixteen,—and forty-three thousand and four *ten millionths*.

Four hundred million, forty thousand and four,—and seven thousand and six hundred *millionths*.

Show the pupil, that in whole numbers the highest denomination is first written, and that the units, tens and hundreds of each succeeding denomination must occupy at least three places, the deficiency (when there is any,) being supplied by 0s. Decimals should be written as whole numbers, and 0s should then be prefixed, if necessary, until the right-hand decimal figure represents the denomination required.

*Examples to be Written in Figures, and Numerated by the Pupil.*

1. Ninety.
2. Sixty-four.
3. Eighty-seven—and one, *tenth*.
4. Sixteen—and four, *hundredths*.
5. Seven hundred—and nineteen, *hundredths*.
6. Three hundred and two.
7. Five hundred and ninety—and eleven, *thousandths*.
8. Six hundred and ninety-nine, *ten-thousandths*.
9. Two thousand and eight, *ten-thousandths*.
10. Five thousand—and five, *thousandths*.
11. Twelve thousand and ninety—and ninety-nine, *hundred-thousandths*.
12. Ninety-nine thousand nine hundred and ninety-nine, *millionths*.
13. Two hundred—and twenty-eight, *millionths*.
14. Two hundred and twenty-eight, *millionths*.
15. Nine hundred and three thousand—and seventeen, *ten-millionths*.
16. Nine hundred and three thousand and seventeen, *ten-millionths*.
17. Eighty-four thousand and seventeen—and three hundred and nine, *ten-thousandths*.
18. Eighty-four—and one hundred and seventy thousand three hundred and nine, *ten-millionths*.

19. Twenty thousand and six—and four hundred and nine, *hundred thousandths*.
20. Thirty thousand one hundred and two—and four hundred and nine, *hundred-millionths*.
21. Nine hundred thousand and nine, *millionths*.
22. Nine hundred thousand and nine, *hundred-millionths*.
23. Nine hundred thousand—and nine, *hundred-millionths*.
24. Six hundred and four million six hundred and four—and seventy-three, *ten-thousandths*.
25. Twenty-eight thousand six hundred and forty-two—and forty-two, *thousandths*.
26. One million three hundred and seven thousand and forty—and seven hundred and three, *ten-millionths*.
27. Forty-seven million nine hundred and sixty thousand eight hundred and thirteen, *hundred-millionths*.
28. Four hundred million—and four, *hundred millionths*.
29. Nineteen million and six—and fifteen, *ten-millionths*.
30. In ninety thousand four hundred and forty-three, *hundredths*, how many *tenths*, units, tens, hundreds, &c?\*
31. In two hundred thousand and twenty-one, *ten thousandths*, how many *thousandths*, *hundredths*, *tenths*, &c.

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\* The number is written 904.43. Then there are 9044 tenths, 904 units, 90 tens, or 9 hundreds.

## CHAPTER II.

## ADDITION.

## EXAMPLE FOR THE BOARD.

A gentleman bought a coat for 21.25 dollars, a vest for 3.00 dollars, and a pair of pantaloons for 5.62 dollars. What did they all cost him ?

**2 Tens.** Writing the numbers so that all the units may fall in one column, all the tenths in another, and so on, we add first the right-hand column: 2 hundredths and 0 hundredths are 2 hundredths, and 5 hundredths and 2 hundredths are 7 hundredths. We therefore write 7 under the column of hundredths. Adding in the same manner the tenths, the units, and the hundreds, we find there are 8 tenths, 9 units, and 2 hundreds. The answer, or sum, is therefore 29.87 dollars.

The sign \$ signifies dollars. The hundredths of dollars are called cents, and the thousandths of dollars, mills.

1. A merchant sold one barrel of flour for \$5.00, one barrel for \$5.62, and one barrel for \$4.37. How much did he receive for the whole ?

2. A gentleman bought a barrel of sweet potatoes for \$1.12, a barrel of flour for \$5.25, and a barrel of sugar for \$18.10. He paid a drayman \$0.50 to take them home ; how much money did he expend for the whole ?

3. What will four bushels of potatoes cost, at \$0.32 a bushel ?

4. What will be a labourer's wages for five weeks, at \$3.11 a week ?

5. How many yards of broadcloth are there in three pieces, the first containing 21.35 yards, the second 27.6 yards, and the third 30.03 yards ?

6. What is the sum of 28, 10.3, 90.56, and 11.01 ?

## ADDITION.

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## EXAMPLE FOR THE BOARD.

Add together 196, 73.22, 18.09, 614.4, and 1.96.

Hundreds.      Tens.      Units.      Tenths.      Hundreds.  
 1 9 6.      7 3 .2 2      1 8 .0 9      6 1 4 .4      1 .9 6  
 ——————  
 9 0 3 .6 7

The sum of the column of hundredths is 17 hundredths, or 1 tenth and 7 hundredths. It would evidently be wrong to write tenths beneath the column of hundredths; we therefore only write down the 7 hundredths, and add, or *carry*, the 1 tenth to the column of tenths. In adding the tenths, we say 9 and 1 to *carry* are 10, and 4 are 14, and 2 are 16. We have here 1 to carry to units' column—and in continuing our work, we find we have 2 to carry to tens, and 2 to hundreds.

Teach the pupil to *prove* his work by adding downwards.

7. A farmer paid for a horse \$75.33, for a cow \$35.87, and for a pair of oxen \$116.99. What did they all cost him?

8. A merchant purchased at different times, the following quantities of corn, viz., 169.22 bushels, 307.9 bushels, 499 bushels, 287.763 bushels, and 565.08 bushels. How much did he purchase in the whole?

9. George Washington was born A. D. 1732. He was elected President when 57 years old, and died in 10 years afterwards. In what year did he die?

10. A gardener has in his nursery 156 apple trees, 879 cherry trees, 96 pear trees, 451 peach trees, 402 plum trees, 1098 ornamental trees, and 297 other trees of various kinds. How many trees are there in the nursery?

11. A ship sails on the first day of her voyage, 89.75 miles, 76.3 miles on the second day, 80.992 miles on the third, and 78.088 miles on the fourth. How far had she gone at the end of the fourth day?

12. A clerk received for his first year's services, \$250.00, for the second \$325.95, and for the third \$459.76. What was the amount of his wages for the first three years?

13. In a certain farm, there are 85 acres of woodland, 96.5 acres of pasture, 143.94 acres under cultivation, and 44.08 acres are covered with water. What is the size of the whole farm?

14. What will six yards of broadcloth cost, at \$5.625 a yard?

15. If  $\frac{1}{4}$  of a house is worth \$763.875, what is the whole house worth?

16. A man bought a barrel of flour for \$4.31, a keg of butter for \$6.625, a chest of tea for \$29.28, and a barrel of molasses for \$15.095. What did they all cost him?

17. If I pay \$4.625 for a ton of coal, how much must I pay for six tons at the same rate?

18. The whole property of a trader failing in business, is worth \$1917.99, which is but  $\frac{1}{4}$  of what he owes. How much does he owe.

19. What is the sum of 9946, 2440, 1908, 26.49, 308.97, and 84036.5?

20. Add 18.44, 184.4, 1844, 1.844, and .1844.

21. Add 1840089, 26.903, 511804.6, 1.2995, and 98.80769.

22. Find the sum of 11223344.55, 667788.0099, 9988776.65, 40403.32211, 987654321, and 9048700-36.5184.

23. Six men entered into a partnership. The first contributed \$1649.07, the second \$2304.75, the third \$988.00, the fourth \$1085.638, the fifth \$3001.362, and the sixth \$2544.25. What was the whole amount invested in the firm?

24. The stock of a grocer cost \$19168.225. How much must he sell it for, to gain \$2087.165?

25. How many times does a clock strike in 24 hours?

26. A merchant buys 169 barrels of flour for \$827.63; 218 barrels for \$911.27; 93 barrels for \$465, and 117 barrels for \$640.00. How many barrels did he buy, and how much did he give for the whole?

27. A draper purchased 2 pieces of broadcloth, containing 56.5 yards, for \$282.50; 3 pieces, containing 96.25 yards, for \$385.00; 1 piece, containing 19.7 yards, for \$87.585, and 4 pieces, containing 80 yards, for \$430.00. How many pieces did he buy? How many yards? What did he give for the whole?

28. A gentleman owned the following property, viz., \$5963.58 in real estate; \$17055.245 in bank stock; \$9142.77 in mortgages, and \$3310.00 in personal property. How much was he worth?

29. If I owe Thomas Williams \$634.96; James Clements \$518.00; James Phillips \$340.87; Charles Vincent \$119.25; Matthew Jacobs \$743.125, and George Johnson \$64.875, how much do I owe them all?

30. The expenses of a family for one year, were as follows; for provisions \$281.773; fuel \$48.24; clothes \$259.195; servants \$69.125; house rent \$125.00, other expenses \$107.375. What were the whole expenses for the year?

31. Add 92990847.61308; 2448973.966007; 57-  
366094, 1176844875.7; 307669088.0007, and 7677.-  
00939.

32. Add 417.60088; 769966.0789; 388456;  
33946.05; 864891779.16005988; 40003.5914, and  
684.000099.

33. Add two thousand five hundred and four—and sixteen, *thousandths*; thirty thousand and seven,—five hundred and nine, *ten-thousandths*; two hundred

and sixty-three thousand and ninety-four—and three thousand eight hundred and ninety-seven, *ten-thousandths*; nine thousand and nine, *hundred-thousandths*; and four thousand four hundred and forty-four—and four thousand four hundred and forty-four, *millionths*.

34. Add *mentally*, 18 and 11; 21 and 15; 36 and 43; 72 and 87; 40 and 69; 82 and 83; 91 and 65; 81 and 77; 58 and 51; 63 and 44; 57 and 30; 21 and 96; 12 and 94; 35 and 42; 56 and 52; 23 and 35; 73 and 16; 44 and 54; 35 and 24.

35. Add *mentally*, 78 and 52; 82 and 49; 98 and 93; 66 and 54; 85 and 95; 37 and 27; 83 and 59; 16 and 95; 24 and 77; 56 and 66; 48 and 84; 68 and 98; 35 and 79; 49 and 54; 66 and 77; 99 and 99; 99 and 88; 79 and 97; 38 and 86; 78 and 45; 38 and 37; 55 and 97; 17 and 83.

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## CHAPTER III.

### SUBTRACTION.

#### EXAMPLE FOR THE BOARD.

A merchant gave \$5.15 for a barrel of flour, and sold it for \$6.25. How much did he gain?

*Writing the numbers, the less under the greater, and taking care to place units under units, tenths under tenths, &c., we commence at the right hand to subtract: 5 hundredths from 5 hundredths leave 0 hundredths; 1 tenth from 2 tenths leave 1 tenth, and 5 units from 6 units leave 1 unit.*

6.2 5 Minuend.

5.1 5 Subtrahend.

1.1 0 Remainder.

1. Samuel had 248 chestnuts, but he gave 145 of them away. How many had he left?
2. A manufacturer made 5916 yards of calico, and sold 4903 yards. How much had he left?
3. A barrel of flour holds 196 pounds. If 73 pounds have been used from a barrel, how much is left?
4. A man bought a horse for 125 dollars, and sold it for 105 dollars. How much did he lose?
5. A cargo of fruit cost \$598.37, but it was so damaged by a storm that the owner lost \$230.34 by the sale of it. For how much did he sell it?
6. A man starting on a journey of 189 miles, went 95 miles the first day, and the remainder the next. How far did he go on the second day?

## EXAMPLE FOR THE BOARD.

Subtract 187.81 from 329.32.

Hundreds.	Tens.	Units.	Tenths.	Hundredths.
3	2	9	.3	2
1	8	7	.8	1

---

Subtracting in the usual way, we cannot take 8 tenths from 3 tenths. In Section VIII of Mental Arithmetic, we have already found, that if 10 be added to two numbers their difference will be the same. This is equally true whether we add ten units, ten tenths, or ten of any denomination. If we then add 10 tenths to the 3, and its equivalent, 1 unit, to the next figure we subtract, the difference will be the same. Then, *whenever any figure of the minuend is smaller than the figure below it in the subtrahend, we may add 10 to the upper figure, and carry 1 to the next figure we subtract.* Proceeding in this way, we say, 8 tenths from 13 tenths leave 5 tenths; 8 units from 9 units leave 1 unit; 8 tens from 12 tens leave 4 tens, and 2 hundreds from 3 hundreds leave 1 hundred.

Teach the pupil to *prove* his work, by adding the subtrahend and remainder.

7. The annual salary of a clerk was \$516.29; his expenses were \$303.97. How much did he save?

8. If I pay \$797.22 for a house lot, and sell it for \$889.41, how much do I make by the sale?
9. The distance between Boston and Providence is 39.849 miles. A traveller wishing to go from the former to the latter place, rode 29.987 miles, and walked the rest of the distance. How far did he walk?
10. From 28.9 subtract 9.437. (Observe that 28.9 is the same as 28.900; the two 0s denoting that there are no hundredths or thousandths.)
11. From a piece of broadcloth containing 19.5 yards, a tailor cut 8.775 yards. How much was left?
12. From a hogshead of molasses, which originally contained 97.7 gallons, 8.649 gallons had leaked out. How much remained?
13. The store of a merchant, valued at \$9906.50, was destroyed by fire. An insurance company paid \$6887.375. What was the owner's loss?
14. Thomas is 17 years old. In what year was he born?
15. A grocer purchased 298.8706 pounds of sugar. After selling 199.68 pounds, how much had he left?
16. If a horse cost \$175.00, and the harness cost \$86.75, how much more did the horse cost, than the harness?
17. A farmer purchased a house for \$1064.28, agreeing to pay \$973.195 in produce, and the rest in money. How much money must he pay?
18. If I possess property worth \$9309.00, and owe \$3892.625, how much shall I be worth after my debts are paid?
19. A merchant sold oil for \$962.37, gaining \$109.364 by the sale. How much did the oil cost him?
20. How long is it since the discovery of America by Columbus, A. D. 1492?

21. How long is it since the first settlement of the United States, at Jamestown, in 1608?

22. How long is it since the Declaration of Independence by the United States, in 1776?

23. What number is 29.561 less than 48.7395?

24. 33.7 is 19.864 larger than what number?

25. If the difference between two numbers is 3.15, and the larger number is 5.069, what is the smaller number?

26. What is the difference between 87.9 and 78.89?

27. Subtract 76908.9 from 88319.76.

28. Subtract 18.44 from 1844.

29. If I purchase a chest of tea for \$25.375, and sell it for \$29.00, how much do I gain?

30. If a horse could run 9.77 miles in an hour, and a greyhound could run 13.024 miles in the same time, how much would the hound gain on the horse in one hour?

31. From 987095200, take 36996186.40091328.

32. What is the difference between nine hundred and sixteen thousand nine hundred — and four, *ten-thousandths*, and eight hundred and seventy-four thousand and forty-nine — and three hundred and eighty-six thousand two hundred and forty-nine, *ten-millionths*?

33. Subtract *mentally*, 17 from 37; 20 from 71; 41 from 62; 56 from 86; 11 from 91; 32 from 43; 50 from 70; 60 from 89; 38 from 88; 13 from 73; 49 from 99; 25 from 55; 72 from 102; 94 from 194; 83 from 84; 21 from 63; 16 from 87; 34 from 78; 25 from 69.

34. Subtract *mentally*, 31 from 44; 22 from 74; 11 from 59; 40 from 83; 15 from 31; 27 from 70; 29 from 86; 32 from 80; 26 from 41; 75 from 92; 35 from 94; 16 from 80; 28 from 76; 27 from 71; 39 from 91; 19 from 62; 14 from 89; 29 from 58.

35. Subtract *mentally*, 78 from 91; 66 from 82; 15 from 90; 18 from 80; 18 from 87; 37 from 73; 57 from 75; 29 from 64; 48 from 92; 19 from 43; 87 from 152; 98 from 173; 77 from 154; 85 from 113; 78 from 135; 96 from 183; 86 from 124; 99 from 197; 66 from 165.

MISCELLANEOUS EXAMPLES.

1. A gentleman received \$418.50 from one man, \$362.75 from another, and \$1198.875 from a third. From the sum he paid \$597.638. How much had he left?

2. Add 16.99, 259.087, 664, and from the sum subtract 774.876.

3. A farmer who had 1984.65 bushels of wheat, sold 156.09 bushels to one man, 288.946 to another, and 476 to another. How much had he left?

4. 2976.3 and 484.95 and 2771, less 886.442, are how many?

5. A merchant deposits in a bank \$1987.00 at one time, and \$2411.75 at another. If he draws out \$769.625, how much will remain in the bank?

6. Add 449, 164.4, 87, 6.91, and subtract 551.3 from their sum.

7. A flour dealer had 2864 barrels in store. How much had he left, after selling 95 barrels to one man, 160 to another, 479 to another, and 1192 to another?

8. 4954 and 495.4 and 49.54 and 4.954, less .4954, are how many?

9. Charles had 175 marbles. How many had he left, after giving 25 to William, 19 to George, 38 to Samuel, 49 to Peter, 41 to John, and losing 2?

10. 68 and 33.3 and 44.6 and 19.1 and 185, less 289, are how many?

11. A vessel starting on a voyage of 2987 miles, sailed 729.4 the first week, 697.31 the second, and 753.08 the third. How far had she still to go?
12. Add 28.37, 56.091, 6.288, and 190, and from this sum subtract 213.75.
13. A tailor charged \$29.75 for a coat, \$48.375 for a cloak, and \$5.875 for a vest. For some defect in the making, he deducted \$9.28 from the bill. What remained to be paid?
14. Add 9988, 776.6, 55.44, 3.322, and .1991, and subtract from the sum, 964.
15. What is the difference between 9940897.62884 and 13988437.07?
16. If the smaller of two numbers is 9.87654321, and their difference is 4.0977387, what is the larger number?
17. If the larger of two numbers is 26.0084009, and their difference is 17.974298364, what is the smaller number?
18. A hogshead of sugar contained 587.965 pounds. How much remained in the hogshead, after 16.0084 pounds had been sold to one man, 96.944 pounds to another, and 205.87 pounds to another?
19. 994876 and 994.876 and 6784.99 and 67849.9 less 2775083 are how many?
20. A man bought five barrels of flour, at \$4.375 per barrel, and sold it at \$4.50 per barrel. How much did he make by the bargain?
21. 89320.014 and 17828 and 435162.5, less 115403.99 and 27916 and 599.0808 are how many?
22. A labourer receives \$1.125 per day, and spends \$0.64 per day, for the support of his family. How much will he save in a week? (Remember that he *works* but six days.)
23. Subtract 99087.043899 from 127563.

## CHAPTER IV.

## MULTIPLICATION.

## EXAMPLE FOR THE BOARD.

If a barrel of flour costs \$4.75, what will 4 barrels cost?

$$\begin{array}{ll}
 (1.) 4.75 & (2.) 4.75 \text{ Multiplicand.} \\
 4.75 & 4 \text{ Multiplier.} \\
 4.75 & \hline \\
 4.75 & 19.00 \text{ Product.} \\
 \hline
 19.00 &
 \end{array}$$

dredths, or 2 tenths and 0 hundredths ; 4 times 7 tenths are 28 tenths, and 2 tenths to carry are 30 tenths, or 3 units and 0 tenths ; 4 times 4 units are 16 units, and 3 units to carry are 19 units.

1. If a yard of broadcloth costs \$6.83, what will 3 yards cost?
2. George, James and Nathan, have each 280 marbles ; how many have they all ?
3. If a clerk receives \$412.50 a year, how much will he receive in 4 years ?
4. A farmer sold 5 sheep, at \$3.56 apiece. What did he receive for them ?
5. How much must I give for 6 tons of hay, at \$9.65 a ton ?
6. If a railroad train goes 15.8 miles an hour, how far will it go in 6 hours ?
7. A man consumes 2.641 pounds of provisions a day. How much will he eat in a week ?
8. What will be the expenses of a family for 8 weeks, at \$6.375 a week ?

9. A teacher bought 9 writing-books, at \$0.125 apiece. How much did he give for them all?

10. If  $\frac{1}{5}$  of a carriage costs \$15.75, what is the cost of the whole carriage?

11. A merchant sold  $\frac{1}{2}$  of a vessel for \$3025.98. What was the whole vessel worth at that rate?

12. If  $\frac{1}{2}$  the stock of a Bank is worth \$259.875, what is the whole stock worth?

13. A farmer divided his farm among his three sons, the share of each being \$449.763. What was the whole worth of the farm?

14.  $\frac{1}{4}$  of an estate is valued at \$1887.06. What is the value of the estate?

15. If  $\frac{1}{2}$  of a pine-apple is worth \$0.0625, what is the whole worth?

16. There are 4.995 yards in  $\frac{1}{2}$  of a piece of broad-cloth; what is the length of the piece?

17. 28.84 is  $\frac{1}{4}$  of what number?

18. 36.0097 is  $\frac{1}{3}$  of what number?

19. Multiply 6690847.795 by 2.

20. Multiply 84.0897736 by 3.

21. Multiply 1741.9658832 by 4.

22. Multiply 9997894625 by 5.

23. Multiply 368.09288775 by 6.

24. Multiply 911874365.2 by 7.

25. Multiply 27880904376 by 8.

26. Multiply 123456789.09 by 9.

27. What will 79.865 pounds of cheese cost, at 7 cents a pound?

28. What is the product of 79.865 by 7?

29. What is the product of 443.2 by 9? by 6? by 8? by 5?

30. What is the product of 9.8764 by 8? by 4? by 9? by 7? by 6?

## EXAMPLES FOR THE BOARD.

If a barrel of flour costs \$4.88, what will 15 barrels cost?

4.88      The product of 4.88 by 5 units, is 24.40. In multiplying by 1 ten, the product will be 10 times as large as the product by 1 unit, and each figure will therefore stand 1 place farther to the left. The product by 1 ten is then 48.8, and the sum of the two products, or the product by 15, is 73.20.

If a barrel of flour costs \$4.88, what will 15.5 barrels cost?

4.88      The units' figure of the multiplier is written under 15.5 the right-hand figure of the multiplicand, because the product of any denomination by units is of the same 2.440 denomination; i. e. units by units give units, tenths by 24.40 tenths give tenths, and so on. The product by tenths 48.8 is 10 times smaller than the product by units, and each 75.640 figure will therefore stand 1 place farther to the right.

Therefore in preparing any numbers for multiplication, *place the units' figure of the multiplier under the right-hand figure of the multiplicand, and place the first figure of each product under the figure by which you multiply. The separatrix of each product will then fall under that of the multiplicand.*

A careful examination of this process will show, that there are always as many decimals in the product as there are in both the multiplier and the multiplicand.

31. What is the cost of 2.2 barrels of flour, at \$4.88 a barrel? What is the cost of 6.6 barrels at the same rate? 7.8 barrels? 11.9 barrels?

32. If a ton of iron costs \$128.75, what is the cost of 16 tons?

33. A farmer bought 18 cows, at \$25.50 apiece. What did they all cost?

34. What must I pay for 76 bushels of wheat, at \$1.125 a bushel?

35. What will be the wages of a labourer for 28 weeks, at \$2.75 per week?

36. When sugar is \$6.125 per hundred weight, what will be the cost of 4.5 hundred weight?

37. If a barrel of cider costs \$1.875, what will 4.25 barrels cost?
38. If a barrel of apples costs \$2.0625, what will 5.8 barrels cost?
39. What will 19.2 tons of hay cost, at \$9.75 per ton?
40. How many yards are there in 96.5 pieces of broadcloth, there being 21.7 yards in each piece?
41. If a man can build 9.473 rods of wall in a day, how much can he build in 5.25 days?
42. If a box of oranges costs \$2.51, how much will 879 boxes cost?
43. How many gallons of molasses will 488 casks hold, if each cask holds 94.125 gallons?
44. What will 9.25 yards of broadcloth cost, at \$5.95 a yard?
45. How many pounds of wool will it take to make 49 pieces of broadcloth, each piece being 21.5 yards long, if 2.5 pounds will make one yard?
46. What must I pay for 18.5 pieces of cloth, there being 35.75 yards in each piece, at 15 cents a yard?
47. How many quarts are there in 13 hogsheads, there being 4 quarts in a gallon, and 63 gallons in a hogshead?
48. 12 inches make one foot, and 3 feet make one yard. How many inches are there in 1 yard? In 16.25 yards?
49. What will 6.789 cords of wood cost, at \$5.67 a cord?
50. If a carriage-wheel is one rod in circumference, how often will it turn round in going 1 mile, or 320 rods? In 16.4 miles?
51. 112 pounds make a hundred weight. What will 4.35 hundred weight of sugar cost, at 8 cents a pound?

52. What is the product of 16.488 by 29.76?
53. What is the product of 947288 by 9.45?
54. What is the product of 659.014 by 2871?
55. What is the product of 7.3561 by 119.4?
56. What is the product of 54321.09 by 2227?
57. What is the product of 8089477 by 3895?
58. What is the product of 436109 by 398489?

## EXAMPLE FOR THE BOARD.

Multiply 2287096 by 308400.

$$\begin{array}{r}
 2287096 \\
 308400 \\
 \hline
 914838400 \\
 18296768 \\
 \hline
 68612880 \\
 \hline
 705340406400
 \end{array}
 \quad \text{The product of } 0, \text{ by any number, is always } 0. \text{ Then, whenever } 0 \text{ occurs in the multiplier,} \\
 \text{write } 0 \text{ beneath it, for its product—and proceed} \\
 \text{to the next figure.}$$

59. Multiply 896.23 by 40060.
60. Multiply 387549.1 by 10000.
61. Multiply 4479.063 by 34000.
62. Multiply 70768400 by 209900.
63. If a pound of figs costs \$0,125, what will 4050 pounds cost at the same rate?
64. Multiply .047 by .0304, and place 0s in the vacant decimal places.
65. What will .501 pounds of raisins cost, at .0875 cents a pound?
66. Find .04008 of .00639.
67. Multiply .00940983 by 6050500.
68. Multiply .487006 by 99087000.
69. Multiply .0008807695 by 300950.
70. Find .004009 of .0706.
71. Find .0009087 of 649088.
72. Find .029501 of .00086473.

73. If a bushel of oats costs \$0.375, what will 4 bushels cost? What will 7 times 4, or 28 bushels cost?

74. If a horse run 8.61 miles an hour, how far will he run in 5 hours? In 3 times 5, or 15 hours?

7 and 4 are called *factors* of 28. In like manner 3 and 5 are factors of 15; 2 and 7 of 14; 3 and 2 and 4 of 24, and so on. Now, whenever the multiplier can be resolved into two or more factors, the product may be obtained, either by employing the whole multiplier, or each of its factors, in succession.

75. If Charles obtains 19 merit marks in a week, how many will he obtain in 35 weeks, or 7 times 5 weeks?

76. If I pay \$0.75 for reaping an acre of wheat, how much must I pay for reaping 24 acres, or 3 times 8 times 4 acres?

77. If a lamp burns .276 pints of oil in an evening, how much will it burn in 36 evenings?

78. How far would a bird fly in 42 hours, at the rate of 17.54 miles an hour?

79. If a wheel turns round 441.5 times in going a mile, how many times would it turn, in 25 miles?

80. If 19.41 gallons of water run from a cistern in an hour, how many gallons will run out in 16 hours?

81. What must I give for 81 gallons of molasses, at \$0.375 per gallon?

82. How many passengers can ride in 18 cars, each car holding 36 persons?

83. Multiply 4099.62 by 64; by 72; by 45.

84. Multiply *mentally*, 19 by 2; 17 by 3; 18 by 4; 18 by 5; 16 by 6; 19 by 7; 19 by 8; 19 by 9; 40 by 10; 21 by 6; 32 by 5; 43 by 5; 46 by 4; 65 by 5; 28 by 6; 17 by 7; 60 by 9; 140 by 8; 91 by 10; 98 by 2; 93 by 3; 44 by 4; 25 by 9; 37 by 6; 130 by 7; 38 by 8; 68 by 7; 36 by 20.

85. Multiply *mentally*, 21 by 11; 16 by 15; 29 by 16; 70 by 25; 32 by 12; 62 by 11; 44 by 13; 17 by 14; 24 by 19; 35 by 14; 41 by 13; 78 by 11; 22 by 14; 33 by 19; 48 by 13; 84 by 11; 15 by 21; 51 by 17; 63 by 12; 22 by 26; 41 by 19; 77 by 12; 83 by 16; 87 by 15; 92 by 20; 83 by 40; 64 by 60.

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## CHAPTER V.

### DIVISION.

#### EXAMPLE FOR THE BOARD.

If 3 pieces of cassimere cost \$150.75, what will 1 piece cost?

Divisor.	
	Dividend.
3)	<u>150.75</u>
Quotient,	<u>50.25</u>

Having written the numbers as in the margin, we find that the 1 hundred does not contain 3; we therefore divide first the 15 tens. 15 tens divided by 3, are 5 tens; 0 units divided by 3 are 0 units; 7 tenths divided by 3 are 2 tenths and there is 1 tenth over; this 1 tenth, joined to the 5 hundredths, gives 15 hundredths, which, divided by 3, give 5 hundredths.

1. If 4 barrels of flour cost \$20.90, what will one cost?
2. If a locomotive goes 126 miles in 6 hours, how far will it go in 1 hour?
3. A grocer paid \$8.92 for 4 barrels of cider; what was that a barrel?
4. A farmer sold 5 bushels of wheat for \$5.05. How much did he receive per bushel?
5. If a bird can fly 51.24 miles in 3 hours, how far can it fly in 1 hour?
6. A garrison consumes 16.8018 barrels of flour in 2 weeks; how much does it consume in 1 week?

7. The cashier of a Bank receives \$510.65 for 5 months' services. How much would he receive for 1 month?
8. A certain creek discharges 1540182 gallons of water in a week. What quantity is discharged daily?
9. Nine men travelling together, found their expenses were \$765.72. What was each man's share?
10. There are 42240 feet in 8 miles. How many feet are there in 1 mile?
11. How many cakes can I buy for 96 cents, at 4 cents apiece?
12. How many hours will it take me to ride 196 miles, if I ride 7 miles an hour?
13. How many hours will it take a ship to sail 3294 miles, sailing 9 miles an hour?
14. How many yards are there in 240123 feet, there being 3 feet in a yard?
15. How many weeks are there in 630014 days?
16. How many sheep can I buy for 280920 dollars, if I pay 4 dollars apiece?
17. If \$1320.054 be divided equally among 6 men, what will be each man's share?
18. If a family of 8 persons receive a fortune of \$9600.48, what will be the share of each?
19. A dairy-woman makes cheeses, that weigh 9 pounds apiece. How many cheeses will weigh 198.0189 pounds?
20. A benevolent society distributed 11208 loaves of bread among a number of poor people, giving 8 loaves to each person. How many persons did they assist?
21. Divide 70196 by 7.
22. Divide 4.0005 by 9.
23. Divide 64000.08 by 8.

24. Divide 3678.04 by 6.
25. Divide 595.085 by 5.
26. Divide 3440000 by 4.
27. Divide 108007389 by 9.
28. How many rows of marbles, 8 in a row, can be made with 66880 marbles?
29. If 1 barrel holds 3 bushels of apples, how many barrels will hold 111000 bushels?
30. If 7 horses eat 15.4091 tons of hay in a year, how much will 1 horse eat?
31. If 8 yokes of oxen can draw 9.616024 tons of stone, how much can 1 yoke draw?
32. If I pay 9 dollars for 2.700558 yards of cloth, how much can I buy for 1 dollar?
33. What is the quotient of 885.00175 by 5?
34. What is the quotient of 11790.03014 by 7?
35. What is the quotient of 1234004213 by 9?
36. What is the quotient of .29631003 by 3?
37. What is the quotient of 9087002914 by 4, and what is the *remainder* after division? If that remainder be divided by 4, what fraction shall we obtain? Then what is the true quotient? *Ans.* 2271750728 $\frac{1}{4}$ .
38. Divide 3360001907 by 6, and make a fraction of the remainder.
39. Divide 4409000 by 7, and make a fraction of the remainder.
40. Divide 830083003 by 8, and make a fraction of the remainder.
41. Divide 4770001 by 9, and make a fraction of the remainder.
42. Divide 285015 by 3, and *prove* the work by multiplying the quotient and divisor together. This product, if the answer is correct, will be equal to the dividend.

43. Divide 901944 by 9, and prove the answer.  
 44. Divide 30068 by 4, and prove the answer.  
 45. Divide 690030 by 5.  
 46. Divide 84120 by 6.  
 47. Divide 47051 by 7.  
 48. Divide 18443 by 8. The remainder must be added to the product of the quotient and divisor, in the proof.  
 49. Divide 9288 by 9.  
 50. Find how many times 7 is contained in 63631.  
 51. Find how many times 4 is contained in 27.0042.  
 52. Find how many times 66.093 contains 5.  
 53. Find how many times 84.0014 contains 6.

## EXAMPLE FOR THE BOARD.

If a labourer receives \$22.86 for 15 days' work, how much does he receive per day?

<i>Divisor.</i>	<i>Dividend.</i>	<i>Quotient.</i>
15 )	22.86	( 1.52
15 ..		
—	78.	
—	75.	
—	36	
—	30	
—	1	
—	6	

This example is solved in the same manner as the foregoing, but the multiplications and subtractions that we have previously performed in our minds, are here written down. We say, 15 in 22 units, 1 time. Write 1 in the quotient, and subtract 1 time 15 from 22. To the remainder, 7, annex the 8 tenths, and say, 15 in 78, 5 times. Write the 5 in the quotient, and subtract the product, as before. To the remainder, 3, annex the 6 hundredths, and proceed as before. The quotient is 1.52, and the remainder 6. This mode of dividing is called *Long Division*, to distinguish it from the former method, which is called *Short Division*.

Show the pupil how to *prove* Multiplication and Division.

54. A journeyman charged \$19.75 for making 21 pairs of boots. How much did he charge per pair?  
 55. If 14 horses eat 6.338 pecks of oats in a week, how much will 1 horse eat in the same time?

56. If a cart-wheel turns round 4681 times, in going 13 miles, how many times will it turn in 1 mile?

57. James distributed 1975 chestnuts among 25 boys. How many did he give to each?

58. A clock strikes 4680 times in 30 days. How many times does it strike in 1 day?

59. If a ship is worth \$15500.00, what is  $\frac{1}{5}$  of it worth?

60. A man purchased a farm for \$960.75, and sold  $\frac{1}{6}$  of it for what it cost him. How much did he receive?

61. If I pay \$34.56 for 33 bushels of wheat, how much must I pay for 1 bushel?

62. A merchant sold 45 pounds of indigo for \$48.75. How much did he receive per pound?

63. What is  $\frac{1}{5}$  of a cargo of sugar worth, the whole cargo being valued at \$4608.25?

64. An estate of \$2559.73 was divided equally among 29 persons. What was the share of each?

65. Divide 11988.4 by 63.

66. Divide 448.7009 by 81.

67. Divide 1488.07 by 109.

68. Divide 3944.56 by 140.

69. What is the quotient of 799.8043 by 151?

70. What is the quotient of 6073298 by 203?

71. What is the quotient of 2597.441 by 234?

72. What is the quotient of 444.763 by 221?

73. The quantity of water discharged by the Falls of Niagara, has been estimated at 6000000 gallons per second. If this estimate is correct, how many hogsheads, each holding 139 gallons, could be filled by the cataract in one second?

## EXAMPLE FOR THE BOARD.

Divide 36.3 by .0017.

$$\begin{array}{r} \cdot 0017 ) 36.3000 ( 21352.94 \\ \underline{34} \dots \\ \underline{23} \dots \\ \underline{17} \dots \\ 60 \dots \\ 51 \dots \\ \underline{90} \dots \\ 85 \dots \\ \underline{50} \dots \\ 34 \dots \\ \underline{160} \dots \\ 153 \dots \\ \underline{70} \dots \\ 68 \dots \\ \underline{2} \end{array}$$

The quotient, when the divisor and dividend are of the same denomination, (i. e. units, tenths, hundredths, &c.) will always be whole numbers. By annexing 3 0s to 36.3, both divisor and dividend will represent ten thousandths; and the quotient, 21352, will be whole numbers. If we continue to add 0s, and extend the division, the quotient figures so obtained will be decimals.

*Always have at least as many decimal places in the dividend as there are in the divisor. Point off as many decimals in the quotient as there are in the dividend more than in the divisor.*

74. Divide 24 by .012.

75. Divide .0072 by 2.4. In this example, 0s must be prefixed to the quotient, to make the required number of decimals.

76. Divide .011 by .33.

77. Divide 17.9 by .042.

78. Divide 8.0062 by .0037.

79. Divide .0008 by 240.

80. Divide .000078 by 156.

81. Divide 78 by .0000156.

82. Divide 489 by 1.76.

83. Divide 1.08 by .072.

84. Divide 6641 by .6641.

85. If 3.05 yards of sheeting cost \$0.377, what is the price per yard?

86. What is the price of a yard of calico, if 4.091 yards cost \$0.511375?

87. How many kegs of butter can I buy for \$198.875, if I pay \$5.375 per keg?

88. How much molasses at \$0.375 per gallon, can be bought for \$15.00?

89. A piece of satin, measuring 29.44 yards, cost \$47.50. What was it worth per yard?

90. If a labourer receives \$27.76 a month, how much can he spend every day, without saving any of his wages?

91. A ship's crew of 29 men, received \$776.84 to be divided equally among them. What was each man's share?

#### EXAMPLES FOR THE BOARD.

Divide 9737 by 35.

$$(1.) \ 35) 9737 \quad (2.) \ 5) 9737$$

70

273

245

287

280

7) 1947.4

278.2

The results in (1) and (2) are the same. Then, whenever the divisor can be resolved into factors, we may either divide at once, by the whole divisor, or by each of its factors in succession.

7.0

7.0

When there are 0s at the right-hand of the divisor, we may cut them off, and remove the decimal point in the dividend as many places to the left as we cut off 0s.

Divide 27506 by 1300.

$$13|00) 275.06 \quad (21$$

26

15

13

2.06

1300 is equal to 13 times 100. Cutting off the 0s from the divisor, and removing the decimal point of the dividend two places to the left, divide each number by 100, because the figure which before represented hundreds, will represent only units. Then, dividing 275.06 by 13, the other factor of the divisor, we have a quotient of 21, and a remainder, 2.06. Removing the decimal point in the remainder to its original place, we have 206 for the true remainder.

91. What is the quotient of 779511 by 800?
92. What is the quotient of 140873 by 76000?
93. What is the quotient of 5591.07 by 430?
94. What is the quotient of .071 by 5000?
95. What is the quotient of 1.85 by 6200?
96. What is the quotient of 99.08 by 370000?
97. What is the quotient of 628 by 4100?
98. What is the quotient of .5056 by 350?
99. What is the quotient of 469.5 by 72000?
100. What is the quotient of .0087 by 1900?
101. Divide 428.3 by 24, using factors of the divisor.
102. Divide 9.112 by 63, using factors of the divisor.
103. Divide .5703 by 36.
104. Divide .0091 by 15.
105. Divide 284.7 by 64.
106. Divide 766.08 by 72.
107. Divide 21194 by 42.
108. Divide 38129 by 25.
109. Divide .063819 by 49.
110. Divide .0007 by 27. E
111. If an acre of land yields 43.7 bushels of corn, how many acres will yield 779.4 bushels?
112. When potatoes are \$0.25 a bushel, how many bushels can be bought for \$66.39?
113. If 2.77 pounds of butter will purchase a barrel of charcoal, how many barrels can be bought with 38.4 pounds?
114. A ship has casks for water, that hold 47.93 gallons apiece. How many casks will hold 618 gallons?
115. Find  $\frac{1}{7}\frac{1}{8}$  of 55.132.

116. 976.64 is 43.1 times what number?

117. 43308 is 1.97 times what number?

118. Divide *mentally*, 69 by 3; 74 by 2; 64 by 2; 84 by 4; 66 by 2; 82 by 2; 93 by 3; 77 by 7; 39 by 3; 40 by 2; 280 by 7; 55 by 5; 90 by 5; 84 by 7; 560 by 8; 91 by 7; 78 by 6; 42 by 3; 85 by 5; 96 by 2; 76 by 4.

119. Divide *mentally*, 126 by 7; 387 by 9; 264 by 8; 175 by 7; 534 by 6; 192 by 8; 644 by 7; 594 by 9; 324 by 6; 528 by 6; 792 by 8; 945 by 5; 483 by 7; 672 by 8; 883 by 9; 770 by 10; 770 by 7; 770 by 70; 440 by 11; 594 by 11; 516 by 12; 792 by 11; 660 by 12; 429 by 13; 299 by 13; 403 by 13.

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#### THE TRUE QUOTIENT FIGURE

Cannot always be determined, without repeated trials. The number of trials may, however, be often diminished, as in the following example:

Divide 7106 by 187.

187) 7106 (38      The divisor is between 100 and 200, and will therefore be contained in the dividend not as many times as 100, but more times than 200.  
 $\underline{561}$       In dividing by 100 or 200, we need employ only the first figure as a divisor; and if we employ the first figure of each of these numbers as a *trial divisor*, we shall obtain the *limits* within which the true quotient figure is contained.

Now, 1 is contained in 7, 7 times; 2 in 7, 3 times;—7 and 3 are therefore the *limits* of the first quotient figure, which must be either 3, 4, 5, 6, or 7.

As the divisor is nearer 200 than 100, we first try the smallest of these figures, which is found to be the true one. In the same way, we find that 14 and 7 are the limits of the second quotient figure, which must be either 7, 8, or 9, as no single figure can be greater than 9. Trying 7, we find it too small; but 8 is the true figure sought.

*Always employ the first divisor figure, and a number one larger than the first divisor figure, as trial divisors.*

## REVIEW.

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ALL Arithmetical questions, depend on the proper application of one, or more, of the five fundamental operations that have been illustrated in the foregoing chapters, viz., Numeration, Addition, Subtraction, Multiplication, and Division.

In Numeration, numbers are either given in figures to be read in words, or given in words to be written in figures.

In Addition, two or more numbers are given, and their sum, or amount, is required.

In Subtraction, two numbers are given, and their difference required.

In Multiplication, two numbers are given, and their product is required. The product is equivalent to the sum of one of the numbers, repeated as many times or parts of a time, as there are units, or parts of units, in the other. Multiplication is, therefore, a quick way of performing many additions.

In Division, two numbers are given, and their quotient is required. The quotient shows how many times one of the numbers, or a part of it, can be subtracted from the other. Division is, therefore, a quick way of performing many subtractions.

The termination *nd*, signifies *to be*. Thus the subtrahend, is the number to be subtracted; the minuend, the number to be diminished; the multiplicand, the number to be multiplied; the dividend, the number to be divided.

The terminations *er* and *or*, are applied to the one that *does something*. Thus the multiplier, is the

number that multiplies ; the divisor, the number that divides ; the numerator of a fraction, the one that numbers the parts that are taken ; the denominator, the one that denominates, or names the value of the parts.

## QUESTIONS FOR THE PUPIL.

What is the object of Numeration ? How many figures are employed to represent Numbers ? What are they ? What is the use of 0 ? What is a unit ? Repeat the Numeration table. What is the Decimal Point, or Separatrix ? What is the effect of removing a figure one place to the left?—one place to the right ? What is the effect of 0s at the right of decimals ?

What is the object of Addition ? How do you write the numbers that are to be added ? Where do you begin to add ? If the sum of any column is more than 9, what is done with it ?

What is the object of Subtraction ? What is the Minuend ? What is the Subtrahend ? What is the Remainder ? How are the numbers to be written ? Where do you begin to subtract ? If any figure in the Subtrahend is larger than the one over it in the Minuend, what must be done ? How may the truth of the answer be proved ?

What is the object of Multiplication ? What is it a quick way of performing ? What is the Multiplicand ? What is the Multiplier ? What is the Product ? Where do you place the units' figure of the Multiplier ? If the Multiplier contains more than one figure, where do you place the first figure of each partial product ? Where will the decimal point of each product fall ? What is the product of any number by 0 ? What are Factors ? When the Multiplier can be resolved into Factors, how may the product be obtained ? How many decimals will there be in the product ?

What is the object of Division ? What is it a quick way of performing ? What is the Dividend ? What is the Divisor ? What is the Quotient ? What is the Remainder ? Where do you place the Divisor ? If the Dividend has fewer decimals than the Divisor, what must be done ? How many decimals will there be in the Quotient ? When there are Factors to the Divisor, how may the Quotient be obtained ? When there are 0s at the right-hand of the Divisor, what may be done ? How may the Quotient be proved. How may the Product in Multiplication be proved ?

## MISCELLANEOUS EXAMPLES:

The following abbreviations may often shorten the labour required in solving a question.

When the multiplier consists of any number of 9s, increase it by 1, and subtract the multiplicand from the product.

If the multiplier is 5, divide the multiplicand by .2.

If the multiplier is 25, divide the multiplicand by .04.

If the multiplier is 75, multiply by 100, and subtract  $\frac{1}{4}$  of the product.

If the multiplier is 125, divide by .008.

If the multiplier is 375, divide by .008, and multiply the quotient by 3.

If the multiplier is 625, divide by .008, and multiply by 5.

If the multiplier is 875, multiply by 1000, and subtract  $\frac{1}{8}$  of the product.

If the divisor is either of the above numbers, (except 75 or 875,) reverse the process; i. e., multiply instead of dividing, and divide instead of multiplying.

If the divisor is 75, divide by 100, and add  $\frac{1}{4}$  of the quotient.

If the divisor is 875, divide by 1000, and add  $\frac{1}{8}$  of the quotient.

[Let the teacher give examples, illustrating each of the above abbreviations, on the Board.]

1. A bankrupt owed to one man, five thousand and six dollars and sixteen cents; to another, three thousand two hundred and four dollars and nine cents; to another, one thousand nine hundred and seventy dollars and sixty-eight cents; to another, eight hundred and ninety-six dollars and three cents; and to all others, ten thousand and five dollars and eleven cents. What was the whole amount of his debts?

2. From nine hundred and three million two thousand and seventeen—and two hundred and one, *hundred thousandths*, take eight hundred million seventy thousand and four—and five, *ten-millionths*.

3. If a man takes two thousand four hundred and six—and five, *tenths* steps in walking one mile, how many will he take in six—and one hundred and seventy-three, *ten-thousandths* miles?

4. A banking institution made ninety-one thousand and seven dollars, in one thousand and sixteen days. How much were the profits per day?

5. William Johnson bought of John Williamson,  
 4 pieces of muslin, each 31.5 yards, at \$0.125 per yard.  
 6        do.        each 29.75 yards, at \$0.115 per yard.  
 6        do.        each 30.25 yards, at \$0.11 per yard.  
 5        do.        each 31 yards, at \$0.1275 per yard.  
 7        do.        each 30.5 yards, at \$0.135 per yard.

How many yards of muslin did he buy, and what was the amount of his bill?

6. James Clark bought of Jeremiah Appleton,  
 6 chests of tea, each 44.5 pounds, at \$0.625 per pound.  
 3        do.        each 47.2 pounds, at \$0.75 per pound.  
 5        do.        each 51.6 pounds, at \$0.875 per pound.  
 4        do.        each 49 pounds, at \$0.93 per pound.

How many pounds did he buy, and what was the amount of his bill?

7. What is the total population of the world, there being in North America, 30960000 inhabitants; South America, 14040000; Europe, 230000000; Asia, 450000000; Africa, 57000000, and Oceanica, 18000000?

8. What is the number of inhabitants to a square mile, the whole land surface of the earth containing 50000000 square miles?

9. A merchant purchased flour for \$943.25; he paid \$1.375 for carting, and \$6.00 for storage. How much must he sell it for, to gain \$16.43?

10. A merchant bought tea in England for \$2097.76, and paid \$81.61 for freight, and \$47.35 duty. In consequence of damage, he sold the whole for \$1871.44. How much did he lose by the sale?

11. A merchant purchased Russia duck for \$944.79, and paid \$107.47 duty, and \$0.75 drayage. He sold it for \$1206.93; how much did he gain?

12. If I buy goods to the amount of \$1176.06; pay \$33.74 for storage, \$54.16 for commission, and \$49.11 for interest upon the money, and sell the whole for \$1293.97, do I gain or lose?—and how much?

13. An iron-monger paid \$159.86 for 63.5 tons of iron. For how much must he sell the whole, to gain \$38.75? How much per ton?

14. A store-keeper saved \$291.31 the first year; \$345.67, the second; and \$512.50, the third. With these savings he purchased bank-stock, at \$97.50 per share. How many shares did he buy?

15. A farmer has 6.493 tons of old hay in his barns. He cuts 4.76 tons of new hay from one of his meadows, and 13.044 tons from another. How much will he receive for the whole, if he sells it at \$13.75 per ton?

16. If 5.95 bushels of wheat make a barrel of flour, and 15 barrels make a load, how many bushels will be required to make 27.2 loads?

17. The distance from the earth to the sun, is ninety-five million miles. In how many seconds would a cannon-ball go to the sun, moving 2000 feet in a second? In how many minutes, there being 60 seconds in a minute? In how many hours? In how many days?

18. The salary of a clerk was \$1395.00 a year, and the expenses of his family were \$2.75 a day. How much did he save in a year?

19. A prize was divided among four men. The first received \$125.00; the second, three times as much as the first; the third, as much as the first and second; and the fourth, twice as much as the third. How much did each receive, and what was the whole prize?

20. A grocer bought 16 bags of coffee, at \$14.41 per bag. For how much must he sell the whole, in order to gain \$13.77?

21. A gentleman distributed some chestnuts among 16 boys, and 14 girls. To each boy he gave 25, and to each girl, 30. How many did he distribute?

22. A merchant bought 43 casks of molasses, each cask containing 71.25 gallons. Upon selling it, he found that 4.37 gallons had leaked from each cask. How many gallons were left in the whole?

23. A man started upon a journey, travelling at the rate of 6.8 miles an hour. After he had been gone 4.75 hours, an express started in pursuit, going 9.2 miles an hour. How many miles does the express gain in an hour? In how many hours will he be overtaken?

24. A man owed \$242.75. He offered in payment 14 tons of hay at \$10.50 a ton; 45 bushels of oats at \$0.30 a bushel; and the rest in money. How much money did he pay?

25. Four men entering into a partnership, contributed \$7988.375. A. contributed \$956.71; B. contributed \$1872.50; C. contributed \$2440.125. How much did D. contribute?

26. A grocer who had 421 kegs of butter, sold 56 kegs at \$12.50 per keg; 91 kegs at \$11.79 per keg; 100 kegs at \$11.85 per keg; and the remainder at \$11.50 per keg. How much did he receive for the whole?

MISCELLANEOUS QUESTIONS.

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27. How many barrels of cider, at \$2.79 per barrel, can be bought with 63 barrels of apples, at \$2.17 per barrel?

28. A bankrupt could pay only \$0.4375, on every dollar of his debts. How much could he pay on a debt of \$169.00?

29. If 6 horses eat 3.61 tons of hay in a month, how long will 10.32 tons last them? How long will 10.32 tons last 1 horse? 7 horses?

30. If 44.9601 is the subtrahend, and 709.5 is the minuend, what is the remainder?

31. If 751.62 is the subtrahend, and the remainder is 49.076, what is the minuend?

32. If the minuend is 55087, and the remainder is 331.49, what is the subtrahend?

33. If the multiplicand is 1804 and the multiplier is 1804, what is the product?

34. If the product is 10674320000, and the multiplier is 107000, what is the multiplicand?

35. If the divisor is 76000, and the dividend is 4.09, what is the quotient?

36. If the dividend is 84396, the quotient is 125, and the remainder is 21, what is the divisor?

37. Multiply 46943.001 by 999999.

38. Multiply 723008.4 by 875.

39. Multiply 45.0082 by 625.

40. Multiply 89099736410028 by 25.

41. Divide 79684880275 by 25.

42. Divide 8843.089796335 by 5.

43. Divide 4990825 by 75.

44. Divide 911880441375 by 375.

45. Divide 8400915250 by 875.

46. Multiply 9154082.76 by 125.

47. Multiply 2038809515 by 625.

## CHAPTER VI.

## COMPOUND NUMBERS.

## TABLES OF COMPOUND NUMBERS.

## FEDERAL MONEY, or the Currency of the United States.

10 mills (m.) . . . . .	make 1 cent,	ct.
10 cents . . . . .	make 1 dime.	
10 dimes . . . . .	make 1 dollar.	\$
10 dollars . . . . .	make 1 eagle.	

## ENGLISH MONEY, or the Currency of England.

4 farthings (qr.) . . . . .	make 1 penny,	d.
12 pence . . . . .	make 1 shilling,	s.
20 shillings . . . . .	make 1 pound,	£

## TROY WEIGHT, to weigh Gold, Silver, Jewels, and Liquids.

24 grains (gr.) . . . . .	make 1 pennyweight, dwt.	
20 pennyweights . . . . .	make 1 ounce,	oz.
12 ounces . . . . .	make 1 pound,	lb.

## APOTHECARIES' WEIGHT, used for Compounding Medicines.

20 grains (gr.) . . . . .	make 1 scruple,	ʒ
3 scruples . . . . .	make 1 dram,	ʒ
8 drams . . . . .	make 1 ounce,	ʒ
12 ounces . . . . .	make 1 pound,	lb.

The Apothecaries' pound is the same as the Troy pound. Drugs are bought and sold by Avoirdupois weight.

## AVOIRDUPOIS WEIGHT, to weigh all ordinary Commodities.

10 grains, (gr.) . . . . .	make 1 scruple,	sc.
3 scruples . . . . .	make 1 dram,	dr.
16 drams . . . . .	make 1 ounce,	oz.
16 ounces . . . . .	make 1 pound,	lb.
28 pounds . . . . .	make 1 quarter,	qr.
4 quarters . . . . .	make 1 hundred-weight, cwt.	
20 hundred-weight . . . . .	make 1 ton,	T.

The pound Avoirdupois equals 7000 grains Troy.

## DRY MEASURE, to measure all Solids that are not sold by weight.

2 pints (pt.) . . . . .	make 1 quart,	qt.
8 quarts . . . . .	make 1 peck,	pk.
4 pecks . . . . .	make 1 bushel,	bu.
36 bushels of coal . . . . .	make 1 chaldron,	chal.

## WINE MEASURE, to measure most Liquids.

4 gills (gi.) . . . . .	make 1 pint,	pt.
2 pints . . . . .	make 1 quart,	qt.
4 quarts . . . . .	make 1 gallon,	gal.

## APOTHECARIES' MEASURE, used for Compounding Medicines.

60 minimis (m.) . . . . .	make 1 fluidrachm,	f3
8 fluidrachms . . . . .	make 1 fluidounce,	f3
16 fluidounces . . . . .	make 1 pint,	O.
8 pints . . . . .	make 1 gallon,	Cong.

A drop of water is about equal to  $1\frac{1}{2}$  minimis, or 3 drops to 4 minimis, and 45 drops to a fluidrachm.

A pint of water weighs a pound Avoirdupois, *very nearly*.

## **BEER MEASURE, to measure Malt Liquors and Milk.**

2 pints (pt.)	make 1 quart,	qt.
4 quarts	make 1 gallon,	gal.
32 gallons	make 1 barrel,	bl.

The Wine, or Apothecaries' gallon, contains 231 cubic inches; the Beer gallon 282 cub. in.; the English standard, or Imperial gallon, 277.274 cub. in. The old measures, tierce, hogshead, puncheon, &c., are not used.

## CLOTH MEASURE, used for measuring Cloth, &c.

2.25 inches (in.) . . . . .	make 1 nail,	na.
4      nails . . . . .	make 1 quarter,	qr.
4      quarters . . . . .	make 1 yard,	yd.

## **LONG MEASURE, used for Length and Distance.**

3	barleycorns (b. c.) .	make 1 inch,	in.
12	inches .....	make 1 foot,	ft.
3	feet .....	make 1 yard,	yd.
5.5	yards .....	make 1 rod or pole,	r.
40	rods .....	make 1 furlong,	fur.
8	furlongs .....	make 1 mile,	m.
3	miles .....	make 1 league,	lea.
69.5	miles .....	make 1 degree on the earth,	°
360	degrees .....	make the earth's circum- ference.	

## SQUARE MEASURE, to measure Surfaces.

144	square inches . . . . .	make 1 square foot, sq. ft.
9	square feet . . . . .	make 1 square yard, sq. yd.
30.25	sq. yds., or 272.25 sq. ft.	make 1 sq. rod, sq. r.
40	square rods . . . . .	make 1 rood, R.
4	roods . . . . .	make 1 acre, A.
640	acres . . . . .	make 1 square mile, sq. m.

**COMPOUND NUMBERS.**

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**CUBIC MEASURE, to Measure Solids.**

1728 cubic inches . . . . .	make 1 cubic foot,	c. ft.
40 feet of round timber, or 50 feet of hewn timber, . . .	make 1 ton,	T.
16 cubic feet . . . . .	make 1 cord foot,	C. ft.
8 cord feet . . . . .	make 1 cord,	C.

**MEASURE OF TIME.**

60 seconds (sec.) . . . . .	make 1 minute,	min.
60 minutes . . . . .	make 1 hour,	h.
24 hours . . . . .	make 1 day,	dy.
365 days . . . . .	make 1 common year,	Y.
366 days . . . . .	make 1 leap year.	
365 dys. 5 h. 48 min. and 48 sec.	make 1 solar year.	

The year is divided into 12 months. The number of days in each month may be learned thus:

The 4th, 11th, 9th and 6th,  
Have 30 days to each affixed:  
All the rest have 31,  
Except the 2d month alone,  
Which hath but 28 in fine,  
Till leap year gives it 29.

Or as follows :

Thirty days hath September,  
April, June, and November:  
All the rest have thirty-one,  
Except February alone,  
To which we twenty-eight assign,  
Till leap year gives it twenty-nine.

The Leap Years are all those that are divisible by 4, as, 1840; 1844; except the centennial years, 1800; 1900, &c.

## REDUCTION OF COMPOUND NUMBERS.

Reduction is the changing of quantities from one denomination to another; as feet to miles, or miles to feet; pounds to pence, or pence to pounds.

## ENGLISH MONEY.

1. How many farthings are there in 6 pence? 9 pence? 1 shilling?
2. How many pence in 4 shillings? 10 shillings? 1 pound?
3. How many shillings in 6 pounds? 9 pounds? 18 pounds?
4. 400 farthings are how many pence? How many shillings?
5. 360 pence are how many shillings? How many pounds?
6. In £1 2s. 3d. 3qr. how many shillings? How many pence? How many farthings?

## EXAMPLES FOR THE BOARD.

In £26 11s. 9d. 2qr., how many farthings?

<u>£</u>	<u>s.</u>	<u>d.</u>	<u>qr.</u>	We first find the number of shillings, by multiplying the pounds by 20, and adding in the 11 shillings. We then find how many pence, by multiplying the shillings by 12, and adding in the 9 pence. Finally, we find how many farthings, by multiplying the pence by 4, and adding in the $\frac{1}{2}$ farthings.
26	11	9	2	
20				
531	s.			
12				
6381	d.			
4				
<u>25526</u>	<u>qr.</u>			

## COMPOUND REDUCTION.

In 25526 farthings, how many pounds?

4) 25526 qr. There will evidently be fewer pounds than farthings, and we therefore divide the  
12) 6381 d. 2 qr. farthings by 4, the number required to make  
2|0) 531 s. 9 d. 1 penny. We find there are 6381d. 2qr.  
26£ 11 s. Divide the pence by 12, the number required  
Ans. £26 11s. 9d. 2qr. to make 1 shilling, and we find there are  
there £26 11s.

If there are decimals in the number to be reduced, work with them, as with whole numbers.

7. Reduce 13s. 11d. to pence, and to farthings.  
Reduce 13.9166s. to farthings.

8. Reduce £2 5s. 3d. to pence, and to farthings.  
In £2.2625, how many pounds, shillings, and pence?

9. Reduce 4401 farthings to pounds, shillings, pence and farthings.

10. Reduce £4.076 to farthings.

11. Reduce 569 pence to pounds, shillings and pence?

## TROY WEIGHT.

12. How many pounds are there in 72 ounces? 96 ounces?

13. How many ounces in 180dwt.? 60dwt.? 240dwt.?

14. How many ounces in 2 pounds? How many dwt.?

15 In 2lb. 1oz. 19dwt. how many dwt.?

## EXAMPLES FOR THE BOARD.

How many grains in 21lb. 7oz. 19dwt. 3gr.?

How many lb., oz., dwt., and gr., in 11.0644lb.?

How many pounds, &c., in 124779 grains?

16. Reduce .07963lb. to grains.

17. How many pounds, &c., in 400381 grains?

18. How many *dwt.* in  $16lb. 14dwt.$ ? In  $21.594lb.$ ?

19. Reduce 17900 grains to pounds, &c.

20. In 30810.06 grains how many pounds, &c.?

#### APOTHECARIES' WEIGHT.

21. How many scruples in a pound? How many grains?

22. How many pounds in 192 drams? In 1920 drams?

23. Reduce  $19lb. 83\ 33\ 19\ 19gr.$ , to grains.

24. Reduce 944709.2 grains to pounds and the decimal of a pound?

25. In  $6.044lb.$  how many pounds, scruples, &c.? How many grains?

26. How many doses of 10 gr. each in  $7lb.\ 03\ 73\ 29$  of calomel?

#### AVOIRDUPOIS WEIGHT.

27. How many pounds in a hundred-weight? In a ton?

28. How many pounds in 746 drams? How many quarters?

29. Reduce  $1T.\ 13cwt.\ 27lb.$  to grains. Reduce  $1.695T.$  to tons, hundred-weight, pounds, &c.

30. Reduce 5518700 drams to tons, &c.

31. A grocer bought  $18.7187cwt.$  of sugar for \$155.75. What did he give per pound?

32. How many hundred-weight of coffee, at 9 cents a pound, can be bought for \$276.81?

#### DRY MEASURE.

33. How many quarts in a bushel? How many pints?

34. How many pints in 63 bushels and 1 quart?

35. Reduce 77904 pints to bushels, &c.
36. How many chaldrons of coal are there in 59588 bushels?
37. Reduce 79.9375*bu.* to *bu.*, *pk.* &c. In 79.-9375*bu.*, how many pints?
38. If a horse eats 6*qt.* of oats a day, how many bushels, &c. will he eat in a year.

## WINE MEASURE.

39. How many gills in a quart? In a gallon?
40. Reduce 159*gal.* 1*pt.* to gills.
41. How many gallons will be required, to fill 15809 pint bottles? How many hogsheads of 96.5 gallons each?
42. Reduce 79603 gills to hogsheads, &c
43. Reduce 157.762*gal.* to gills.

## APOTHECARIES' MEASURE.

44. How many minimis in a fluidounce?
45. Reduce 555973 minimis to gallons, &c.
46. How many drops of water in 3*Cong.* 1*O.* 13*f3* 1*f3*?
47. How many 2 ounce phials, may be filled with 8*Cong.* 4*O.* 14*f3*?
48. How many drops of water in a pint? In 1.473 gallons?

## BEER MEASURE.

49. How many pints in a barrel? In 5.079 barrels?
50. If a family use 3 pints of milk in a day, how many gallons, &c. will it use in a year?
51. How long will 6 barrels of ale supply a man, who drinks a pint a day?

52. Reduce 19.55996*l.* to *bl.* *gal.* &c.  
 53. Reduce 4008 pints to barrels and decimals of a barrel.

## CLOTH MEASURE.

54. How many inches in a quarter? In a yard?  
 55. In 62.409 yards how many *yd.*, *qr.*, &c.? How many inches?  
 56. In 5592 inches how many yards, &c.?  
 57. Reduce 38*yd.* 3*qr.* 3*na.* to inches. To yards and decimals of a yard.

## LONG MEASURE.

58. How many barleycorns in a foot? In a yard?  
 59. In 5.679*m.* how many miles, furlongs, &c.? How many inches?  
 60. How many miles in 1584000 inches?  
 61. How many miles in the circumference of the earth?  
 62. How many yards of wire would surround the globe?  
 63. Reduce 97790.814 inches to miles and decimals of a mile.  
 64. Reduce 5.5 miles to barleycorns.

## SQUARE MEASURE.

## EXAMPLE FOR THE BOARD.

How many square rods in a piece of land, 6 rods long and 4 rods wide?

Illustrate this question by drawing a parallelogram. Show that a strip of land, 6 rods long and 1 rod wide, will contain 6 square rods, and that there will therefore be as many times 6 square rods as there are rods in the width. Hence the rule for obtaining the number of square inches, feet, or rods, in any surface, multiply the NUMBER of inches, feet, or rods, in the length,

*by the number in the breadth.* Do not use the term "multiply the length by the breadth," for feet cannot be multiplied by feet—the multiplier always being an abstract number.

65. How many square inches in a piece of board, 16.1 inches long, and 11.5 inches wide?

66. How many square inches in 6A. 3R. 39r.? How many acres and decimals of an acre?

67. How many acres, &c. in a field 96 rods long and 27 rods wide?

68. How many yards of carpeting that is 1 yard wide, will cover a floor 15.5 feet long and 12 feet wide?

#### CUBIC MEASURE.

##### EXAMPLE FOR THE BOARD.

How many cubic inches in a block, 3 inches long, 2 inches wide, and 2 inches thick?

Illustrate this question by dividing a potato, or a block of wood, and thence deduce the rule for finding the solid contents of any thing; *multiply the number of feet or inches, in the length, breadth, and thickness, together.*

69. How many cubic inches in a block, 5 inches long, and of the same breadth and thickness?

70. Reduce 3.494 T. of hewn timber to Tons, feet, &c. To cubic inches.

71. What must I pay for a pile of wood 32 feet long, 8 feet wide, and 4.5 feet high, at \$4.75 per cord?

#### TIME MEASURE.

72. How many seconds in an hour? In 10 hours?

73. How many seconds in a common year? In a solar year?

74. Reduce 506800 seconds to days, &c.

75. Reduce 89 days 13 hours to seconds.

76. If a ship sails 8.43 miles an hour, how far will it sail in 13 days 21 hours?

77. Reduce 15*h.* 24*min.* to the decimal of a day.

78. Reduce 19.751 days to *dy. h. min., &c.*

### ADDITION OF COMPOUND NUMBERS.

#### EXAMPLE FOR THE BOARD.

What is the sum of 14*r.* 3*yd.* 2*ft.* 11*in.*; 9*r.* 4*yd.* 7*in.*; 28*r.* 1*ft.*; 47*r.*; and 11*r.* 3*yd.* 11*in.*?

r.	<i>yd.</i>	<i>ft.</i>	<i>in.</i>	
14	" 3 "	2 "	11	29 <i>in.</i> , which is equal to 2 <i>ft.</i> 5 <i>in.</i> Write down the 5 <i>in.</i> and carry the 2 <i>ft.</i> to the column of feet. We find there are 5 <i>ft.</i> , equivalent to 1 <i>yd.</i> 2 <i>ft.</i> Write down the 2 <i>ft.</i> and carry the 1 <i>yd.</i> There are 11 <i>yds.</i> , equivalent to 2 <i>r.</i> 0 <i>yds.</i> Write 0 <i>yds.</i> and carry 2 <i>r.</i> Finally, there are 11 <i>r.</i> , equivalent to 2 <i>fur.</i> 31 <i>r.</i>
<i>fur.</i> _____				
2	" 31 "	0 "	2 "	5

1. Add 17*r.* 5*yd.* 9*in.*; 28*r.* 3*yd.* 1*ft.*; 4*r.* 4*yd.* 2*ft.* 7*in.*; 2*yd.* 1*ft.* 11*in.*, and 37*r.*

2. Add 6*lb.* 5*oz.* 19*dwt.* 4*gr.*; 11*lb.* 11*oz.* 21*gr.*; 4*oz.* 8*dwt.* 23*gr.*; 29*lb.*, and 17*lb.* 2*oz.* Troy.

3. Add 5*T.* 19*cwt.* 3*qr.* 17*lb.* 5*dr.*; 13*T.* 7*cwt.*; 4*cwt.* 3*qr.* 11*lb.*; 2*T.* 8*cwt.* 11*dr.*; 27*lb.* 15*dr.*, and 18*T.* 5*lb.* 2*sc.* 9*gr.*

4. Add 4*Cong.* 7*O.* 13*f3* 7*f3* 11*m*; 3*Cong.* 36*m*; 5*O.* 8*f3*; 2*O.* 11*f3* 3*f3*, and 13 *Cong.* 4 *O.*

5. Add, in Wine Measure, 14*gal.* 1*pt.*; 127*gal.* 2*qt.*; 3*qt.* 1*pt.* 3*gi.*, and 59*gal.* 3*qt.* 3*gi.*

6. Add, in Beer Measure, 4*bl.* 7*gal.*; 12*bl.* 13*gal.*; 1*bl.* 18*gal.* 2*qt.* 1*pt.*, and 27*bl.* 23*gal.* 1*pt.*

7. Add 36*bu.* 3*pk.* 3*qt.*; 79*bu.* 2*pk.*; 147*bu.* 5*qt.* 1*pt.*; 411*bu.* 1*pt.*, and 215*bu.* 1*pk.* 7*qt.* 1*pt.*

8. Five pieces of cloth measured as follows: 29yd. 2qr. 2na.; 18yd. 1qr. 3na.; 23yd. 3na.; 30yd. 3qr., and 25yd. 1qr. 1na. How many yards were there in the whole?

9. A man paid for a carriage £120 7s. 3d. 3qr.; for a pair of horses £93 18s. 11d.; for a harness £18 4s. 9d. 2qr., and for a livery suit £17 13s. 6d. What did the whole cost him?

10. Add 4lb 63 33 19 19gr.; 8lb 73 73 29 5gr.; 26lb 113, and 8lb. 73 14gr.

11. Add 3Y. 169dy. 13h. 59min. 59sec.; 1Y. 287dy. 11h.; 4Y. 364dy. 28min. 32sec.; 2Y., and 7Y. 19dy. 18h.

12. Add 13A. 2R. 39r.; 4A. 3R.; 12A. 1R. 28r.; 163A. 2R. 22r., and 81A. 17r.

13. Add 18C. 7C.ft. 15c.ft.; 41C. 3C.ft. 1c.ft.; 27C.; 20C. 4C.ft., and 6C.ft. 14c.ft.

14. Add 9Y. 29dy. 7h. 41min. 41sec.; 87dy. 3min. 23sec.; 184dy. 17h. 46sec.; 5Y. 116dy., and 2Y. 211dy. 14h.

15. Add 28m. 7fur. 39r.; 14m. 5fur. 18r. 2yd.; 14m.; 5m. 8r. 5yds. 2ft., and 96m. 6fur. 3yds. 1ft.

16. Add 16yd. 2na. 1.5in.; 25yd. 1qr. 3na. 2in.; 21yd. 3na. 1in.; 19yd. 3qr. 3na., and 5yd. 1na.

17. Add 59gal. 3qt. 3gi.; 58gal. 1qt. 1pt.; 47gal.; 23gal. 2qt. 1pt., and 62gal. 1pt. 1gi.

18. Add £161 19s. 4d. 2qr.; £94 17s. 3d. 1qr.; £115 14s.; £268 11d. 3qr., and £490 1s. 11d. 1qr.

19. Add 76T. 3qr. 11dr.; 114T. 19cwt. 27lb; 269T. 4cwt. 3qr. 7lb. 15dr., and 681T. 19cwt. 3qr. 27lb. 15oz. 15dr.

20. Add, in Troy Weight, 19lb. 10oz. 10dwt. 10gr.; 27lb. 9oz. 18dwt. 23gr.; 41lb. 11oz., and 35lb. 19dwt. 14gr.

21. Add 4chal. 35bu. 3pk.; 19chal. 1pk.; 27chal. 18bu. 2pk. 7qt., and 33chal. 14bu. 1pk. 1qt.

## COMPOUND SUBTRACTION.

## EXAMPLE FOR THE BOARD.

A farmer had 13 T. 7cwt. 26lbs. of hay. How much had he left, after selling 9 T. 8cwt. 3qrs. 18lbs.?

T. cwt. qr. lb.  
 13 " 7 " 0 " 26  
 9 " 8 " 3 " 18  


---

 3 " 18 " 1 " 8

18lb. from 26lb. leave 8lb.; 3qr. cannot be taken from 0qr.—we therefore increase both quantities, by 1 cwt. by adding 4 qrs. to the 0qr. and 1 cwt. to the 8cwt. of the subtrahend. Then, 3qr. from 4qr. leave 1qr.; 9cwt. from 27 cwt. leave 18 cwt.. and 10T. from 13T. leave 3T.

1. A grocer purchased 19cwt. 27lb. 6oz. of sugar, and sold 6cwt. 1qr. 5lb. 11oz. How much had he left?
2. A farmer planted 5bu. 1pk. 3qt. 1pt. of wheat, from which he harvested 97bu. 2pk. 2qt. How much did he gain?
3. A road-contractor agreed to build 16m. 3fur. 5yd. 1ft. of road. After building 3m. 7fur. 2r. 2yd. 2ft., how much remained to be done?
4. A jeweller bought 5lb. 5oz. 18gr. of gold, and afterwards exchanged 1lb. 3oz. 16dwt. 19gr. for other jewelry. How much gold had he left?
5. A grocer placed 5hhd. of molasses in his cellar, each hhd. holding 113.2gal. How much had he left, after selling 49gal. 2qt. 1pt.?
6. From 5Cong. 3O. 12f3 6f3 59m take 1Cong. 7O. 5f3 7f3 11m.
7. A brewer sold 5bl. 26gal. of ale to one man, and 3bl. 27gal. to another. How much did the first buy, more than the second?
8. After selling 9yd. 3qr. 2na. from a piece of broad-cloth containing 21yd. 3qr. 3na. how much was left?
9. If a man's income is £229 11s. a year, and his expenses are £179 14s. 3qr., what does he save?

10. From a medicinal mixture, containing  $3lb.$   $63\frac{29}{40}$ , an apothecary sold  $1lb. 103\frac{73}{100} 29\frac{7}{10} gr.$  How much was left?

11. Thomas wishes to know how many gallons, pints, &c. will be left after pouring 90 drops from  $6Cong. 5O.$  of water.

12. Subtract  $19Y. 276dy. 4h. 41m. 27sec.$  from  $21Y. 15dy.$

13. From a farm of  $149A. 3R.$  the owner sold a piece  $31r.$  long and  $30r.$  wide. How many acres, &c. did he sell, and how many had he left?

14. From a pile of wood  $48ft.$  long,  $8ft.$  wide and  $5ft.$  high, a load was sold  $8ft.$  long,  $5ft.$  wide and  $6ft.$  high. How many cords, &c. were there in the original pile? How many in the load that was sold? How many were left?

15. If  $5gal. 3qt. 1pt.$  leak from a hogshead holding  $113gal. 2qt.$ , how much will be left?

16. James left home  $2Y. 31dy.$  ago, expecting to return in 3 years. How soon may his friends look for him?

17. A man started on a journey of 69 miles, and rode  $24m. 7fur.$   $39r.$  without stopping. How far had he still to go?

18. Subtract  $1829Y. 11mo. 27dy.$  from  $1844Y. 7mo. 28dy.$

19. A man borrowed a sum of money, on 9th mo. 16th, 1837, which he paid, with interest, 3d mo. 1st, 1841. How long did he keep the money?

20. Samuel was born August 18th, 1820. How old was he, May 3d, 1844?

21. How many hours elapsed, from the Declaration of Independence, July 4th, 1776, to the commencement of the 19th century, January 1st, 1801?

## COMPOUND MULTIPLICATION.

## EXAMPLE FOR THE BOARD.

How much gold in 23 ingots, each ingot weighing  $7lb. 9oz.$   
 $18gr.$ ?

lb.	oz.	dwt.	gr.
7	9	0	18
		7	
54	3	5	6
		3	
162	9	15	18
15	6	1	12
178	3	17	6

Rather than multiply directly by 23, I multiply by 7 and 3, the factors of 21; and having found the weight of 21 ingots, I add the weight of 2 ingots, which gives the weight of 23 ingots. The answer might also have been found by multiplying by 8 and 3, the factors of 24, and subtracting the weight of 1 ingot. In the multiplication we say, 7 times 18gr. are 126gr., equal to 5dwt. 6gr.; 7 times 0dwt. are 0dwt. and 5 to carry are 5dwt.; 7 times 9oz. are 63oz., equal to 5lb. 3oz., and 7 times 7lb. are 49lb. and 5 to carry, are 54lb.

1. How much iron is there in 9 loads, each load weighing  $1T. 7cwt. 3qr. 20lb. 5oz.$ ?
2. If  $2bu. 3pk. 7qt. 1pt.$  of corn will fill a barrel, how much will 29 barrels hold?
3. If a locomotive run  $16m. 25r. 2yd.$  in an hour, how far will it run in 11 hours?
4. What is the weight of 31 bars of silver, each bar weighing  $4lb. 11oz. 16gr.$ ?
5. How much molasses in 43 casks, each cask holding  $97gal. 1.5pt.$ ?
6. How much water in 15 demijohns, each holding  $4Cong. 7O. 3f3\frac{1}{2}.$ ?
7. How much ale in 22 casks, there being  $7gal. 3qt. 1pt.$  in each?
8. How many yards of sheeting in 37 pieces, each measuring  $31yd. 3qr. 2.5na.$ ?
9. A draper purchased  $59yd.$  of cloth at  $\text{£1 } 19s. 3qr.$  per yard. What did he pay for the whole?

10. An apothecary compounded 39 prescriptions, putting 13 63 11gr. in each. What did the whole weigh?

11. How many acres, &c. in 41 pieces of ground, each piece being 51r. long and 28r. wide?

12. In a certain lumber yard there were 17 piles of wood, each pile being 11ft. long, 4ft. wide and 6ft. high. How many cords, &c. were there in the yard?

13. How many tons of hewn timber in 13 logs, each log being 1.5ft. thick, 2ft. wide and 48.5ft. long?

14. Multiply 1 Y. 11dy. 9h. 59sec. by 23.

15. Multiply 7m. 7fur. 4yd. 11in. by 9.

16. Multiply £16 7s. 11d. 1qr. by 29.

17. Multiply 10yd. 3qr. 2na. by 46.

18. Multiply 2T. 19cwt. 12lb. by 47.

19. Multiply 359gal. 3gi. by 13.

20. Multiply 5chal. 4bu. 3pk. by 67.

21. Multiply £7.963 by 25, and reduce the product to pounds, shillings, &c.

22. In 17 times 11.851gal., how many gal., qt., &c.?

23. In 31 times 13.0951dy., how many seconds?

24. Reduce 50 times 11.914in. to rods and decimals of a rod.

25. In 65 baskets of coal, each holding 2.75 bushels, how many chaldrons, bushels, &c.?

26. Multiply 9.759cwt. by 23, and reduce the product to ounces.

27. In 39 times 3.7yd., how many yd. qr. &c.?

28. How many drops of water in 2hhd., each holding 97.5gal.?

29. How many pints of chestnuts, in 9 baskets, each holding 1.37 bushels?

## COMPOUND DIVISION.

## EXAMPLE FOR THE BOARD.

A legacy of £2114 18s. 9d. 2qr. was divided among 17 men. What was each man's share?

**£ s. d. qr.**    **£ s. d. qr.** We first divide the  
 17) 2114 " 18 " 9 " 2 ( 124 " 8 " 1 " 3 $\frac{1}{4}$  pounds, and find there  
 $\underline{17}$   
 $\underline{41}$   
 $\underline{34}$   
 $\underline{74}$   
 $\underline{68}$   
 $\underline{6}$   
 $\underline{20}$   
 17)  $\underline{138}$  ( 8s.  
 $\underline{136}$   
 $\underline{2}$   
 $\underline{12}$   
 17)  $\underline{33}$  ( 1d.  
 $\underline{17}$   
 $\underline{16}$   
 $\underline{4}$   
 17)  $\underline{66}$  ( 3 $\frac{1}{4}$  qr.  
 $\underline{51}$   
 $\underline{15}$

are £6 remain undivided. Reduce these £6 to shillings, and add them to the 18s. Then dividing the shillings, we can give to each 8s. and have 2s. undivided. Reduce these 2s. to pence, and add the 9d. Dividing the pence, we can give 1d. to each, and have 16d. left. Finally, reducing 16d. to quarters, and adding the 2qr., we can give to each 3 $\frac{1}{4}$ .

1. If 17yd. 3qr. 2na. will make 5 suits of clothes, how much will make 1 suit?
2. In 4 casks of equal size there are 3bl. 3qt. of beer. How much is there in each cask?
3. If 7 demijohns hold 31Cong. 5O. 15f $\frac{3}{4}$ , how much do they hold apiece?
4. A jeweller bought 6 agates of equal size, weighing together 1lb. 5oz. 13gr. What was the weight of each?

5. Divide 258.4*gal.* of molasses among 19 men, and tell how much each will receive.
6. A railway train went 103*m. 7fur.* in 4.5 hours. What was the rate per hour?
7. The horses in a livery stable ate 42*bu. 3pk. 6qt.* of oats in 39 days. What quantity was used daily?
8. How many bins, holding 48*bu. 7qt.* each, can be filled from 197*bu. 3pk.* of oats? *Reduce both to quarts.*
9. In 47 boxes, there are 4*T. 18cwt. 3qr.* of sugar. How much is there in each box?
10. If 31 pounds of indigo cost £19 14*s.*, what is the price per pound?
11. Divide 14*lb 73 33* by 17.
12. A farm of 41*A. 3R.* was divided into 33 lots of equal size. How much did each lot contain?
13. If 19 logs of hewn timber measure 21*T. 39c.ft.*, what does each log measure?
14. Divide 3*Y. 360dy.* into 23 equal parts.
15. If 25 barrels of flour hold 2*T. 8cwt. 3qr.* what does 1 barrel hold? How many pounds?
16. Divide 7*m. 7fur. 4yd. 11in.* by 51.
17. Divide £380 16*s. 3d.* by 44.
18. Divide 187*chal. 43bu. 1pk.* by 57.
19. Divide 221.47*gal.* of wine by 42.
20. Divide 29*yd.* by 79.
21. Divide £37.9461 by 40, and reduce the quotient to shillings, pence, &c.
22. Divide 45.97 days by 3.2, and reduce the quotient to days, hours, &c.
23. Divide 49.775*cwt.* by 5.83, and reduce the quotient to *cwt., qr., &c.*

## CHAPTER VII.

## PER CENTAGE.

INSURANCE against fire or other injury, INTEREST for the use of money, &c., are generally estimated at a certain number of hundredths, called the *rate per cent.* (from the Latin *per centum*, signifying *by the hundred.*) Thus, 1 per cent. is .01; 6 per cent. is .06;  $5\frac{1}{2}$  per cent. is  $.05\frac{1}{2}$  or .055;  $7\frac{1}{4}$  per cent. is  $.07\frac{1}{4}$  or .0725; and so on.

## EXAMPLE FOR THE BOARD.

A merchant insured his warehouse for \$11390.75, paying a premium of 2 per cent. for the insurance. How much did he pay?

11390.75      Multiplying by the rate per cent., we find that  
 .02            he must pay \$227.815.

227.8150

1. What must I pay to insure a house worth \$2250.00, at a premium of .015?

2. What is 2 per cent. of \$169.00?

3. What is 3 per cent. of \$2081.50?

4. What is 5 per cent. of \$1873.46?

5. What is 7 per cent. of \$4009.81?

6. A railroad corporation declared a dividend of 6 per cent. on its stock. What was the dividend on \$7630.00?

7. What is 9 per cent. of \$641.00? If then, a merchant buys flour for \$641.00, for how much must he sell it, to gain 9 per cent.?

8. If I buy 11 tons of hay for \$127.00, for how much must I sell the whole, to gain 15 per cent.? How much per ton?

9. A butcher bought 28 beeves for \$829.00. At how much must he sell them apiece, to gain 18 per cent.?

10. A man invested \$1491.87, which was all his property, in a partnership, and he gained 21 per cent. the first year. What was he worth at the end of the year?

11. What is 1 per cent. of \$2981.00?  $\frac{1}{2}$  per cent.?  $1\frac{1}{2}$  per cent.?

12. What is  $5\frac{1}{2}$  per cent. of \$1430.00?

13. What is  $\frac{1}{2}$  per cent. of \$963.00?  $1\frac{1}{2}$  per cent.?

14. What is  $3\frac{1}{2}$  per cent. of \$4221.00?

15. What is  $\frac{1}{4}$  per cent. of \$8772.00?

16. What is  $6\frac{1}{2}$  per cent. of \$2180.00?

17. A bankrupt was able to pay only 72 per cent. of what he owed. How much would he pay on a debt of \$1628.25?

## INTEREST.

**Interest**, is an allowance of a certain per cent. for the use of borrowed money. The **Principal**, is the amount on which interest is paid. The **Rate**, is the per centage agreed upon for one year's interest. The **Amount** is the sum of principal and interest.

1. What is the interest of \$28.00 for 1 year, at 6 per cent.? In other words, what is 6 per cent. of \$28.00?

2. What is the interest of \$75.00 for 1 year, at 5 per cent.? What for 2 years? 3 years? 4 years?

3. What is the interest of \$127.00 for 2 years, at 6 per cent.? What is the amount?

4. What is the interest of \$229.50 for 4 years, at 7 per cent.? What is the amount?

5. What is the interest of \$1291.00 for 8 years, 5 per cent.? What is the amount?

## EXAMPLE FOR THE BOARD.

When the rate is 6 per cent. for 1 year, what will be the rate for 3 years 6 months and 13 days? Then what is the interest of \$287.00 for 3yr. 6mo. 13dy. at 6 pr. ct.?

3|0) 1.300 days.

12 ) 6.433 mo.

3.536 years.

.06

.21216 rate.

287.00

1.48512

16.9728

42.432

60.88992

We first reduce the months and days to the decimal of a year. This is done by annexing decimal 0s to the days, and dividing by 30. We thus obtain .433mo. for the value of 13dy., or 6.433mo. for 6mo. 13dy. Dividing the months by 12, we obtain .536yr., equal to 6mo. 13dy., or 3.536 years, equal to 3yr. 6mo. 13dy. Then, if the rate for 1yr. is .06, the rate for 3.536 years will be .21216. Multiplying \$287.00 by this rate, we obtain \$60.889 for the interest required.

6. When interest is 6 per cent. a year, what will be the rate for 2yr. 6mo.? What is the interest of \$72.00 for 2yr. 6mo., at 6 per cent.?

7. When interest is 5 per cent. a year, what is the rate for 3yr. 4mo. 12dy.? What is the interest of \$250.00 for 3yr. 4mo. 12dy., at 5 per cent.?

8. What is the interest of \$63.00 for 4yr. 8mo. 6dy., at 7 per cent.? What is the amount?

9. What is the interest of \$121.00 for 4yr. 2mo., at 5 per cent.? What is the amount?

10. What is the interest of \$47.50 for 5yr. 24dy., at 5 per cent.? What is the amount?

11. What is the interest of \$175.00 for 5yr. 9mo., at 6 per cent.? What is the amount?

12. What is the interest of \$875.00 for 7yr. 6mo. 18dy., at 6 per cent.? What is the amount?

13. What is the interest of \$1100.00 for 3yr. 3mo. 9dy., at 7 per cent.? What is the amount?

14. What is the interest of \$125.00 for 6mo. 9dy., at 8 per cent.? What is the amount?

15. What is the interest of \$999.00 for 10mo. 27dy., at 6 per cent.? What is the amount?

16. What is the interest of \$25.00 for 11mo. 18dy., at 6 per cent.? What is the amount?

17. What is the amount of \$375.00 for 9yr. 6mo., at 6 per cent.?

18. What is the amount of \$625.00 for 8yr. 9mo., at 7 per cent.?

19. What is the amount of \$1456.00 for 19dy., at 6 per cent.?

20. What is the amount of \$799.00 for 24dy., at 9 per cent.?

EXAMPLE FOR THE BOARD.

Find the interest of \$4632.25, for 3yr. 7mo. 21dy., at 6 per cent.

3yr. 7mo. are 43mo.	4632.25	When the rate is .06
2) 430	.0210	for 1yr. or 12 months, it
215	.0035	will be .03 for 6 months,
.0035	—	.12 for 24 months; and
2185	rate for {	generally, <i>half as many</i>
3yr. 7mo. 21dy. {	926.450	<i>hundredths as there are</i>
	1012.146625	<i>months.</i> Then, for 1mo.

or 30dy., the rate would be  $\frac{1}{2}$  of .01 or .005; for  $\frac{1}{2}$  of a month, or 6 days, it would be .001, and generally  $\frac{1}{2}$  as many thousandths as are equivalent to the number of days. Hence the following rule to find the rate for any given time at .06 per annum. Call the years and months reduced to months, so many hundredths, and call the days so many thousandths. Divide the hundredths by 2, and the thousandths by 6, and the sum of the two quotients will be the rate required.

21. What is the interest of \$2984.00 for 2yr. 8mo. 27dy., at 6 per cent.?

22. What is the interest of \$1449.00 for 3yr. 7mo. 21dy., at 6 per cent.?

23. What is the interest of \$9999.00 for 5yr. 11mo. 3dy., at 6 per cent.?

24. What is the interest of \$5000.00 for 7yr. 10mo. 6dy., at 6 per cent.?

25. What is the amount of \$391.00 from 1834, Jan. 15, to 1842, Aug. 9, (1834Y. 1mo. 15dy. to 1842Y. 8mo. 9dy.,) at 6 per cent.?

26. What is the amount of \$1250.00 from Feb. 7, 1836 to Jan. 1, 1844, at 6 per cent.?

27. What is the amount of \$6250.00 from Oct. 18, 1835 to May 29, 1841, at 6 per cent.?

28. What is the interest of \$8750.00 from March 30, 1839 to June 3, 1844, at 6 per cent.?

29. What is the interest of \$5599.00 from Aug. 29, 1837 to July 13, 1843, at 6 per cent.?

30. What is the amount of \$7001.50 from Sept. 16, 1829 to Nov. 2, 1842, at 6 per cent.?

EXAMPLE FOR THE BOARD.

What sum of money, at 6 per cent. will amount to \$284.00 in 2yr. 6mo. 18dy., or what is the present worth of \$284.00, due in 2yr. 6mo. 18dy.?

\$1.00 in 2yr. 6mo. 18dy., will amount to \$1.153; therefore, \$1.00 is the present worth of \$1.153, due in 2yr. 6mo. 18dy. Now, \$284.00 contains \$1.153, 246.313 times; and the present worth of \$284.00 is therefore 246.313 times as much as that of \$1.153, or \$246.313. Hence, to find the present worth of any amount—divide by the amount of \$1.00 for the time. If the present worth be subtracted from the principal, the remainder is called the discount.

31. What is the present worth of \$4824.00 due in 3yr. 5mo. 6dy., at 6 per cent.? What is the discount?

32. What is the present worth of \$5000.00 due in 2yr. 9mo., at 6 per cent.? What is the discount?

33. What is the present worth of \$6320.00 due in 3yr. 4mo., at 5 per cent.? What is the discount?

34. What is the difference between the interest, and the discount of \$1175.00 for 5yr. 7mo. 15dy., at 6 per cent.?

35. What is the present worth of \$10000.00 due Jan. 1, 1850, at 6 per cent.?

## EXAMPLE FOR THE BOARD.

What is the amount of \$279.50, for 3yr. 5mo. 24dy., at 6 per cent., compound interest?

36. What is the amount of \$131.25 for 2yr. 6mo., at 6 per cent. compound interest?

37. What is the amount of \$249.00 for 3yr. 4mo. 12dy., at 6 per cent. compound interest?

38. What is the amount of \$350.00 for 4yr., at 6 per cent. compound interest?

39. What is the amount of \$575.00 for 5yr. 3mo., at 5 per cent. compound interest?

40. What is the compound interest of \$625.00 for 5yr. 21dy., at 5 per cent?

## CHAPTER VIII.

## FRACTIONS.

FRACTIONS have been shown, in Mental Arithmetic, Sect. XVII., to result from division, and are expressed by writing the dividend for a numerator, and the divisor for a denominator.

A *proper fraction*, is less than 1, and therefore its numerator is less than its denominator; as,  $\frac{1}{2}$ .

An *improper fraction*, is equal to, or greater than 1, and therefore its numerator is equal to, or greater than its denominator; as,  $\frac{2}{1}$ ,  $\frac{7}{3}$ .

A *mixed number*, is a whole number combined with a fraction; as,  $4\frac{1}{2}$ .

A *compound fraction*, is a fraction of a fraction; as,  $\frac{1}{2}$  of  $\frac{2}{3}$  of  $\frac{1}{2}$ .

An improper fraction may be reduced to a whole or mixed number, *by dividing the numerator by the denominator*, as in Mental Arithmetic, Sect. XVIII.

A mixed number may be reduced to an improper fraction, *by multiplying the whole number by the denominator, and adding the numerator*, as in Mental Arithmetic, Sect. XXIII.

A whole number may be written in the form of an improper fraction, by writing 1 for a denominator ; as, 17,  $1\frac{1}{1}$ .

A compound fraction may be reduced to a simple fraction, *by multiplying all the numerators together for a new numerator, and all the denominators for a new denominator*, as in Mental Arithmetic, Sect. XX.

A fraction may be reduced to a decimal, by *performing the division which is expressed by the fraction* ; that is, *by annexing decimal 0s to the numerator, and dividing by the denominator*.

#### EXAMPLES FOR THE BOARD.

Reduce  $\frac{187}{15}$  to a mixed number. Reduce  $\frac{518}{27}$  to a whole number. Reduce  $19\frac{3}{15}$  to fifteenths. Reduce 19 to twenty-sevenths. Reduce  $\frac{1}{4}$  of  $\frac{2}{3}$  of  $\frac{6}{7}$  of  $\frac{9}{13}$  to a simple fraction. Reduce  $\frac{13}{23}$  to a decimal.

1. Reduce  $\frac{694}{3}$  to a mixed number.
2. Reduce  $\frac{4815}{9}$  to a whole number.
3. Reduce  $71\frac{2}{7}$  to an improper fraction.
4. Reduce 25 to elevenths.
5. Reduce  $\frac{1}{2}$  of  $\frac{1}{3}$  of  $\frac{1}{4}$  of  $\frac{2}{3}$  to a simple fraction.
6. Reduce  $\frac{2}{3}$  to a decimal.
7. Reduce to a decimal, each of the following fractions.  $\frac{2}{3}, \frac{5}{16}, \frac{4}{7}, \frac{2}{3}, \frac{2}{5}, \frac{5}{6}, \frac{6}{7}, \frac{7}{8}, \frac{8}{9}, \frac{7}{11}, \frac{1}{13}$ .
8. Reduce to a whole or mixed number, each of the following fractions :  $1\frac{19}{7}, 2\frac{23}{8}, 6\frac{61}{9}, 1\frac{17}{17}, 3\frac{65}{7}, 1\frac{1844}{4}, \frac{2220}{11}$ .

9. Reduce to a simple fraction, each of the following compound fractions.  $\frac{2}{3}$  of  $\frac{4}{5}$ ,  $\frac{1}{2}$  of  $\frac{1}{3}$ ,  $\frac{1}{6}$  of  $\frac{2}{3}$  of 2,  $\frac{2}{3}$  of  $\frac{1}{2}$  of  $\frac{4}{5}$ ,  $\frac{2}{3}$  of 48.

10. Reduce to an improper fraction, each of the following mixed numbers.  $4\frac{1}{2}$ ,  $17\frac{2}{3}$ ,  $41\frac{5}{14}$ ,  $10\frac{6}{19}$ ,  $5\frac{13}{21}$ .

## ADDITION OF FRACTIONS.

1. Add  $\frac{2}{7}$ ,  $\frac{3}{7}$ ,  $\frac{1}{7}$ ,  $\frac{4}{7}$ ,  $\frac{5}{7}$  and  $\frac{6}{7}$ , and reduce the result to a mixed number.

2. Add  $\frac{1}{8}$ ,  $\frac{2}{8}$ ,  $\frac{3}{8}$  and  $\frac{4}{8}$ , and reduce the result to a mixed number.

3. Add  $\frac{1}{5}$ ,  $\frac{2}{5}$ ,  $\frac{3}{5}$  and  $\frac{3}{5}$ .

4. Add  $2\frac{1}{5}$ ,  $3\frac{2}{5}$ ,  $4\frac{2}{5}$  and  $5\frac{2}{5}$ .

5. Add  $7\frac{3}{11}$ ,  $\frac{4}{11}$ ,  $2\frac{1}{11}$ ,  $3\frac{9}{11}$  and  $\frac{8}{11}$ .

6. Add  $4\frac{7}{19}$ ,  $13\frac{5}{19}$  and  $1\frac{8}{19}$ .

7. Add  $\frac{29}{172}$ ,  $\frac{48}{172}$ ,  $\frac{115}{172}$ ,  $\frac{119}{172}$ , and 4.

8. Add  $1\frac{1}{4}$ ,  $2\frac{1}{2}$ ,  $\frac{7}{8}$ , and  $\frac{4}{3}$ , by reducing each fraction to a decimal.

9. Add  $\frac{3}{8}$ ,  $\frac{4}{5}$ , and  $21\frac{1}{4}$ , by reducing each fraction to a decimal, continuing the decimals to *ten-thousandths*.

10. Add  $3\frac{1}{8}$ ,  $\frac{3}{8}$ , and  $62\frac{9}{11}$ .

11. Add \$1.56 $\frac{1}{4}$ , \$2.21 $\frac{1}{4}$ , and \$5.90 $\frac{1}{4}$ .

12. A farmer sold some corn for \$14.62 $\frac{1}{2}$ , rye for \$7.33 $\frac{1}{2}$ , oats for \$2.31 $\frac{1}{4}$ , and barley for \$5.66 $\frac{1}{4}$ . How much did he receive for the whole?

## EXAMPLE FOR THE BOARD.

Add  $4\frac{1}{6}$ ,  $3\frac{2}{5}$ , and  $2\frac{1}{7}$ .

We cannot add sixths, fifths and sevenths, any more than tons, pounds and ounces, because they are of different denominations. We may, however, reduce them to decimals, and add, or we may reduce them to a *common denominator*, and add their numerators. Multiplying all the denominators together, we obtain 210. Now, if we suppose any thing divided into 210 parts, we can find the value of 6ths, 5ths, and 7ths, in 210ths. As  $\frac{210}{6} = 35$

equal to 1,  $\frac{1}{2}$  is  $\frac{25}{210}$ ;  $\frac{1}{3}$  is  $\frac{42}{210}$ , and  $\frac{2}{3}$  are  $\frac{84}{210}$ ;  $\frac{1}{4}$  is  $\frac{35}{210}$ , and  $\frac{1}{2}$  are  $\frac{105}{210}$ . The above numbers are therefore equivalent to  $4\frac{35}{210}$ ,  $2\frac{24}{210}$ , and  $2\frac{120}{210}$ , which, when added, give  $10\frac{79}{210}$ .

13. Add  $6\frac{1}{2}$ ,  $7\frac{3}{4}$ , and  $8\frac{7}{8}$ .
14. Add  $9\frac{1}{2}$ ,  $10\frac{1}{4}$ , and  $11\frac{1}{2}$ .
15. What is the sum of  $5\frac{1}{2}$  and  $6\frac{1}{4}$ ?
16. What is the sum of  $3\frac{1}{4}$  and  $4\frac{2}{3}$ ?
17. What is the sum of  $14\frac{3}{4}$  and  $26\frac{4}{7}$ ?
18. What is the sum of  $\frac{2}{3}$ ,  $\frac{5}{6}$ , and  $\frac{1}{2}$ ?
19. What is the sum of  $18\frac{1}{2}$ ,  $1\frac{1}{2}$ ,  $5\frac{1}{2}$ , and  $26\frac{1}{2}$ ?
20. What is the sum of  $\frac{2}{3}$ ,  $3\frac{1}{2}$ ,  $\frac{5}{6}$ , and  $14\frac{1}{2}$ ?

#### SUBTRACTION OF FRACTIONS.

##### EXAMPLE FOR THE BOARD.

From  $14\frac{3}{4}$  subtract  $2\frac{1}{2}$ .

$14\frac{3}{4}$      $14\frac{3}{4}$      $\frac{3}{4}$  are equivalent to  $1\frac{9}{4}$ , and  $\frac{9}{4}$  to  $\frac{54}{16}$ . We can  
 $2\frac{1}{2}$      $3\frac{1}{2}$  not subtract  $\frac{5}{2}$  from  $\frac{9}{4}$ ; we therefore add 1 or  
 $\frac{16}{16}$  to the  $\frac{9}{4}$  of the minuend, and carry 1 to the  
 $11\frac{3}{4}$  2 units of the subtrahend.

1. Subtract  $11\frac{1}{2}$  from  $21\frac{1}{2}$ ;  $7\frac{1}{2}$  from  $18\frac{1}{2}$ ;  $23\frac{1}{2}$  from  $24\frac{1}{2}$ .
2. Subtract  $14\frac{1}{2}$  from  $15\frac{1}{2}$ ;  $6\frac{1}{2}$  from  $11\frac{1}{2}$ ;  $2\frac{1}{2}$  from  $2\frac{1}{2}$ .
3. Subtract  $9\frac{1}{2}$  from  $10\frac{1}{2}$ ;  $28\frac{1}{2}$  from  $31\frac{1}{2}$ ;  $1\frac{1}{2}$  from  $10\frac{1}{2}$ .
4. Subtract  $19\frac{1}{2}$  from  $48\frac{1}{2}$ ;  $5\frac{1}{2}$  from  $6\frac{1}{2}$ ;  $23\frac{1}{2}$  from  $33\frac{1}{2}$ .
5. Subtract  $12\frac{1}{2}$  from  $14\frac{1}{2}$ ;  $2\frac{1}{2}$  from  $41\frac{1}{2}$ ;  $\frac{11}{2}$  from  $55\frac{1}{2}$ .
6. Reduce the following fractions to decimals, and find their difference,  $14\frac{1}{2}$  and  $21\frac{1}{2}$ ;  $30\frac{1}{2}$  and  $4\frac{1}{2}$ ,  $\frac{1}{2}$  and  $\frac{1}{2}$ .

7. A farmer had \$15 $\frac{1}{4}$ . How much had he left, after laying out \$4 $\frac{1}{2}$  for flour?

8. If I start upon a journey of  $137\frac{1}{3}$  miles, and go  $89\frac{1}{2}$  the first day, how far have I to go on the second?

9. A certain garden contained  $1\frac{1}{8}$  acres, of which  $\frac{5}{11}$  of an acre were occupied with fruit, and the rest with vegetables. How much was planted with vegetables?

10. If I sell  $\frac{1}{3}$  of a farm to one man, and  $\frac{1}{2}$  of the remainder to another, what part have I left?

#### MULTIPLICATION OF FRACTIONS.

##### EXAMPLE FOR THE BOARD.

Multiply  $8\frac{2}{3}$  by  $3\frac{5}{7}$ ; that is, multiply  $\frac{26}{3}$  by  $\frac{26}{7}$ .

If any number is multiplied by  $\frac{3}{4}$ , the product is  $\frac{3}{4}$  as large as if it were multiplied by 1. In other words,  $\frac{3}{4}$  times 17 is the same as  $\frac{3}{4}$  of  $17\frac{1}{1}$ . Multiplication of fractions is therefore performed in the same way as reduction of compound to simple fractions. The answer to the above sum is  $19\frac{24}{21}$ , or  $30\frac{3}{7}$ .

1. Multiply  $\frac{4}{5}$  by 3; by  $\frac{2}{3}$ ; by  $2\frac{1}{3}$ .
2. Multiply 4 by  $\frac{1}{2}$ ; by  $\frac{1}{3}$ ; by  $11\frac{2}{3}$ .
3. Multiply  $3\frac{1}{2}$  by 2; by  $\frac{5}{11}$ ; by  $6\frac{1}{2}$ .
4. Multiply  $7\frac{1}{2}$  by  $4\frac{1}{2}$ ; by  $9\frac{2}{3}$ ; by  $10\frac{1}{2}$ .
5. If a horse eats  $6\frac{1}{2}$  quarts of oats a day, how much will he eat in 5 days? In  $7\frac{1}{2}$  days?
6. If a barrel of flour costs \$5 $\frac{1}{2}$ , how much will  $7\frac{1}{2}$  barrels cost?
7. If a locomotive runs  $17\frac{3}{11}$  miles an hour, how far will it run in  $5\frac{1}{2}$  hours?
8. How much must I pay for  $96\frac{3}{11}$  pounds of sugar, at 11 $\frac{1}{2}$  cents a pound?
9. When cider is \$0.18 $\frac{1}{2}$  a gallon, what will be the cost of  $23\frac{1}{2}$  gallons?

## DIVISION OF FRACTIONS.

## EXAMPLES FOR THE BOARD.

Divide  $\frac{6}{25}$  by  $\frac{3}{5}$ . Divide  $2\frac{1}{7}$ , ( $\frac{15}{7}$ ) by  $1\frac{5}{9}$ , ( $\frac{14}{9}$ .)

The answer to the first question, dividing numerator by numerator, and denominator by denominator, is found to be  $\frac{2}{5}$ . The second example does not admit of so ready a division. But if we reduce both fractions to a common denominator, the question is resolved into the division of  $\frac{162}{83}$  by  $\frac{98}{83}$ , which gives  $\frac{162}{98}$ , or  $1\frac{64}{98}$ . [See Mental Arithmetic, Sect. XXIV.] We may obtain the quotient in another manner, as follows:

$\frac{15}{7}$  contains  $1, \frac{18}{7}$  times. It contains  $\frac{1}{9}$ , 9 times as often as 1; that is, 9 times  $\frac{18}{7}$ , or  $1\frac{62}{7}$  times. It contains  $\frac{14}{9}$ ,  $\frac{1}{14}$  as often as  $\frac{1}{7}$ ; that is,  $\frac{1}{14}$  of  $1\frac{62}{7}$ , or  $\frac{162}{98}$  times. Now, if we had inverted the divisor, and multiplied  $1\frac{62}{7}$  by  $\frac{9}{14}$ , the result would have been the same. Therefore, when one fraction cannot be directly divided by another, we may either *reduce them both to a common denominator, and divide their numerators, or invert the divisor, and proceed as in multiplication.*

1. Divide  $\frac{2}{3}$  by  $2, (\frac{2}{1})$ ; by  $\frac{1}{3}$ ; by  $\frac{2}{6}$ .
2. Divide  $\frac{4}{15}$  by  $4$ ; by  $\frac{2}{3}$ ; by  $1\frac{1}{2}, (\frac{4}{3})$ .
3. Divide  $\frac{4}{7}$  by  $\frac{1}{6}$ ; by  $\frac{2}{5}$ ; by  $\frac{3}{7}$ .
4. Divide  $\frac{2}{3}$  by  $\frac{2}{3}$ ; by  $\frac{1}{4}$ ; by  $2\frac{1}{6}$ .
5. Divide  $1\frac{1}{2}$  by  $2\frac{2}{3}$ ; by  $3\frac{3}{4}$ ; by  $4\frac{4}{5}$ .
6. Divide  $7\frac{5}{6}$  by  $\frac{1}{18}$ ; by  $3\frac{1}{2}$ ; by  $6\frac{2}{5}$ .
7. What is the quotient of  $14\frac{1}{8}$  by  $2\frac{1}{7}$ ; by  $15$ ; by  $21\frac{1}{2}$ ?
8. What is the quotient of  $3$  by  $\frac{4}{11}$ ; by  $1\frac{1}{15}$ ; by  $6\frac{5}{23}$ ?
9. If  $5\frac{1}{2}$  barrels of flour cost \$22 $\frac{1}{2}$ , what is the price per barrel?
10. If a labourer receives \$9.47 $\frac{1}{2}$  for  $8\frac{1}{2}$  days' work, what are his daily wages?
11. Divide  $13\frac{1}{3}$  by  $9\frac{6}{13}$ ; by  $21\frac{7}{9}$ ; by  $42\frac{2}{3}$ ; by  $16$ .

## REDUCTION OF FRACTIONS.

## EXAMPLE FOR THE BOARD.

Reduce  $\frac{42}{56}$  to its lowest terms.

$\underline{7})\underline{4}2|\underline{8}$      $\underline{2})\underline{5}6|\underline{3}$  Dividing any number by 1 does not alter its value. Therefore, if we can find any number that will divide both the numerator and denominator of a fraction, without a remainder, we may perform the division, and the resulting fraction will have the same value. In this example, we find that 7 will divide both 42 and 56. As  $\frac{7}{7}$  equal 1, which is the quotient of  $\frac{42}{56}$  by  $\frac{7}{7}$  or 1, is equivalent to  $\frac{42}{56}$ . Dividing  $\frac{6}{8}$  again by  $\frac{2}{2}$ , we obtain  $\frac{3}{4}$ , as the *lowest terms* of the fraction  $\frac{42}{56}$ .

The discovery of common divisors may often be facilitated, by attending to the following rules, viz.:

2 will divide any number, whose right-hand figure is either 0, 2, 4, 6, or 8.

3 will divide any number, if the sum of its figures is divisible by 3.

4 will divide any number, if its two right-hand figures are divisible by 4.

5 will divide any number, whose right-hand figure is either 0 or 5.

9 will divide any number, if the sum of its figures is divisible by 9.

10 will divide any number, whose right-hand figure is 0.

11 will divide any number, if the sum of its *odd* digits, (the 1st, 3d, 5th, &c.,) differs from the sum of its *even* digits, (the 2d, 4th, 6th, &c.,) by 0 or 11.

1. Reduce each of the following fractions to its lowest terms.  $\frac{6}{8}$ ;  $\frac{5}{10}$ ;  $\frac{7}{11}$ ;  $\frac{3}{8}$ ;  $\frac{10}{100}$ ;  $\frac{8}{18}$ ;  $\frac{11}{33}$ ;  $\frac{14}{44}$ ;  $\frac{12}{32}$ .

2. Reduce each of the following fractions to its lowest terms.  $\frac{27}{36}$ ;  $\frac{81}{90}$ ;  $\frac{45}{63}$ ;  $\frac{17}{34}$ ;  $\frac{180}{360}$ ;  $\frac{500}{600}$ ;  $\frac{830}{3180}$ ;  $\frac{256}{1024}$ ;  $\frac{63}{99}$ .

## TO REDUCE DECIMALS TO FRACTIONS.

*Write the decimal for a numerator, and the denomination tenth, hundredth, &c. for a denominator, and reduce this fraction to its lowest terms.* Thus, .5 is  $\frac{5}{10}$  or  $\frac{1}{2}$ ; .25 is  $\frac{25}{100}$  or  $\frac{1}{4}$ .

1. Reduce each of the following decimals to a fraction. .3; .07; .009; .216; .00309; .0007803; .91604; .0007.

TO REDUCE FRACTIONS OF A HIGHER DENOMINATION,  
TO WHOLE NUMBERS OF A LOWER, AND THE REVERSE.

This may be done in the same way as reduction of whole numbers, by multiplying, or dividing, as the case may require.

## EXAMPLES FOR THE BOARD.

Reduce  $\frac{5}{8}$  of a mile to furlongs, &c.

Reduce 24min. 31sec. to the fraction of a day.

1. Reduce  $\frac{1}{3}$  of a bushel to pecks, &c.
2. Reduce  $\frac{1}{4}$  of a day to hours, &c.
3. Reduce  $\frac{1}{8}$  of a gallon to pints, fluidounces, &c.
4. Reduce 5s. 0d. 3qr. to the fraction of a £.
5. Reduce 1qr. 2na. to the fraction of a yard.
6. Reduce 9d. 1qr. to the fraction of a shilling.
7. Reduce .934£ to s. d., &c.
8. Reduce 5cwt. 3qr. to the fraction of a ton.
9. Reduce .076 miles to furlongs, &c.
10. Reduce 1R. 30r. to the fraction of an acre.
11. Reduce .89m to the fraction of a gallon.
12. Reduce 5.7min. to the fraction of a year.
13. Reduce .9889T. to cwt., qr., &c. To drams and the fraction of a dram.

## CHAPTER IX.

## ANALYSIS.

In the following chapter, a mental question is first given, to illustrate the succeeding example for the slate. Let the pupil learn to *first find the answer for one, and afterwards for many.*

1. If 4 barrels of flour cost \$20.00, what will be the cost of 1 barrel? Of 7 barrels?
2. If 3.5 barrels of flour cost \$17.75, what will be the cost of 1 barrel? Of 9.25 barrels?
3. If 5 bushels of wheat cost \$5.00, what will 1 bushel cost? 3 bushels?
4. If 6.25 bushels of wheat cost \$7.125, what will 1 bushel cost? 9.5 bushels?
5. If 9 horses eat 54qts. of oats in a day, how much will 1 horse eat? 5 horses?
6. If 19 horses eat 4bu. 2pk. of oats in a day, how much will 1 horse eat? 13 horses?
7. What part of a shilling is 1 penny? 2 pence? 7 pence?
8. What part of a pound (240 pence) is 1 penny? 7s. 6d. (90 pence.)?
9. What part of a month is 1 day? 2 days? 16 days?
10. What part of a year is 1 day? 2mo. 19dy., (79 days.)?
11. What part of .8 is .1? .2? .3?
12. What part of 3.5 (3.50), is .01? .25? 9.25?
13. What part of 19 is 1? 13?
14. What part of 11s. 4d. 1qr. (545qr.) is 4s. 3d. (204qr.)?

15. What part of 63 gal. (2016 gi.) is 1 gal. 1 pt. 2 gi. (38 gi.)?
16. What part of 3 pk. 7 qt. is 1 pk. 1 pt.?
17. If a man walks 3 miles an hour, how far will he walk in 5 hours?
18. If a man walk  $3\frac{1}{2}$  miles an hour, how far will he walk in  $11\frac{3}{5}$  hours?
19. If 3 nails of cloth cost 6 cents, what will 1 nail cost? 1 qr. ? 1 yd.?
20. If 3 nails of cloth cost  $7\frac{1}{2}$  cents, what will 1 nail cost? 1 yd. ?  $4\frac{1}{2}$  yd.?
21. Two railway trains start from the same point, in opposite directions; one travels 10 miles an hour, and the other 15 miles an hour. How far apart will they be in 1 hour? In 4 hours?
22. Two railway trains start from the same point, in opposite directions; one travels  $12\frac{1}{2}$  miles an hour, and the other  $14\frac{1}{2}$  miles an hour. How far apart will they be in  $7\frac{1}{2}$  hours?
23. Anthony bought 4 oranges at 3 cents apiece; what did he give for them all? How many apples at 2 cents apiece would pay for them?
24. A man sold  $5\frac{1}{2}$  tons of hay, at \$11.50 per ton, and received his pay in sheep at  $\$3.83\frac{1}{3}$  apiece; how many did he receive?
25. If a bushel of grain will last 5 horses a week, how long will it last 1 horse? 2 horses?
26. If 12 bushels of grain will last 13 horses a month, how long will it last 9 horses?
27. How long will it take 1 man to eat a barrel of provisions, that 10 men will eat in 6 days? How long will it take 2 men to eat the same barrel? 3 men? 6 men? 20 men? 30 men?
28. How long will it take 13 men to eat a barrel of provisions that 9 men will eat in  $7\frac{1}{2}$  days?

29. If a barrel of flour will last 8 men 4 days, how many men would it last 1 day? 2 days? 8 days? 16 days?

30. If 6 barrels of flour will last 24 men 16 days, how many men would it last 96 days?

31. If 2 bushels of grain supply 4 horses 5 days, how long will it supply 1 horse? How long will 6 bushels supply 1 horse? 3 horses?

32. If  $5\frac{1}{2}$  bushels of grain supply 5 horses 6 days, how long will  $7\frac{1}{2}$  bushels supply 8 horses?

33. If \$20.00 will buy 10 bushels of wheat, what part of a bushel will \$1.00 buy? How much can be bought for \$30.00?

34. If \$56.75 will buy  $47\frac{1}{2}$  bushels of wheat, how many bushels will \$87.50 buy?

35. When a boy 3 feet high, casts a shadow of 2.5 feet, how large a shadow will a man 6 feet high, cast? (1ft. will cast  $\frac{1}{2}$ , and 6ft. will cast  $\frac{2}{3}$  as long a shadow as 3ft.)

36. When a steeple  $125.3\text{ft.}$  high, casts a shadow of  $91\text{ft.}$ , how long a shadow will a steeple of  $187.29\text{ft.}$  cast?

37. When a boy 3 feet high, casts a shadow of  $2\text{ft.}$ , how tall must a man be to cast a shadow of  $4\text{ft.}$

38. When a post  $17\frac{1}{2}$  feet high, casts a shadow  $11\frac{1}{2}$  feet, how high must the post be that casts a shadow of  $18\frac{1}{4}\text{ft.}$

39. If a grocer pays 9 pence for 3 pounds of sugar, how much must he pay for 7 pounds?

40. If a grocer pays £17 4s. 6d. for 14cwt. of sugar, what must he pay for 23cwt.?

41. If 2qt. 1pt. (5pt.) of molasses cost 15 cents, what will 3qt. (6pt.) cost?

42. If 4hhd. 19gal. 1pt. of molasses cost \$79.00, what will 7hhd. 3qt. cost?

43. If 2d. 3qr. (11qr.) pay for 1 pound of sugar, how many elevenths of a pound may be bought with 5d. 2qr. (22qr.)? How many pounds?

44. If £1 10s. pay for 1cwt. of sugar, how many cwt. may be bought with £13 3s.?

45. If 9 apples cost 18 cents, what will 11 apples cost?

46. If .9 of a bushel of rye cost \$0.63, what will .17 of a bushel cost?

47. If 4 acres of land cost \$20.00, what will 7 acres cost?

48. If  $\frac{2}{3}$  of an acre of land cost \$17.00, what will  $\frac{1}{3}$  of an acre cost?

49. If 3 yards of cloth that is 4 quarters wide, will make a coat, how many yards would be required of cloth that is 1 quarter wide? 6 quarters wide?

50. If  $9\frac{1}{7}$  yards of cloth that is  $5\frac{1}{2}$  quarters wide, will make a cloak, how many yards would be required of cloth that is  $6\frac{1}{2}$  quarters wide?

51. A man can do a piece of work in 6 days, by working 9 hours a day; how many days will it take him, if he works but 1 hour a day? 3 hours a day? 6 hours a day?

52. If it takes a man  $7\frac{1}{2}$  days to perform a piece of work, working  $8\frac{1}{2}$  hours a day, how long will it take him if he works  $9\frac{1}{2}$  hours a day?

53. If I divide 27 cents among an equal number of boys and men, giving each man 6 cents, and each boy 3 cents, how many cents do I give to a man and a boy? Then how many of each will share my money?

54. A man divided \$26.32 among an equal number of boys and men, giving \$2.41 to each boy, and \$4.17 to each man. How many were there of each?

55. Three men joined in a speculation; A. contributed \$2.00, B. \$3.00, and C. \$4.00. What part of the whole gain should be given to each dollar that was contributed? Then what part should each man receive?

56. Three men entered into a partnership; A. contributed \$150.00, B. \$175.00, and C. \$188.00. What part of the profits should each man receive?

57. Three men bought a piece of cloth, for which A. paid \$2.00, B. \$1.00, and C. \$3.00. What part of the gain should each man receive? They gained \$1.20; how much was each man's share?

58. Three men traded in partnership; A. contributed \$230.00, B. \$215.00, and C. \$300.00. What part of the profits should each receive? They gained \$249.00; what was the share of each?

59. If I lend \$4.00 for 3 months, how many dollars ought I to receive in return, to use 1 month?

60. If I lend \$175.50 for  $5\frac{1}{3}$  months, how much ought I to receive in return, to use 1 month?

61. A. and B. were partners; A. put in \$2.00 for 3 months, and B. put in \$4.00 for 1 month. What part of the gain was each one's share?

62. A. and B. were partners; A. put in \$187.00 for  $4\frac{1}{2}$  months, and B. put in \$263.00 for 2.8 months. What part was each one's share of the gain?

63. Three men traded in partnership; A.'s money, which was \$2.00, remained 2 months; B.'s money, which was \$3.00, remained 1 month; and C.'s money, which was \$1.00, remained 4 months. They gained \$1.10; what was the share of each?

64. Three men traded in partnership; A. put in \$161.00 for 3.5 months, B. put in \$145.00 for 4.25 months, and C. put in \$200.00 for 3 months. They gained \$49.00; what was each man's share?

65. If a man can do  $\frac{1}{5}$  of a piece of work in a day, and a boy can do  $\frac{1}{8}$  in the same time, how much will they both do in a day? How long will it take them to do the whole?

66. If a man can do  $\frac{1}{7}$  of a piece of work in a day, and a boy can do  $\frac{2}{11}$  in the same time, how much will they both do in a day? How long will it take them to do the whole?

67. A. can build a wall in 4 days, and B. can build it in 8 days. What part can each build in 1 day? What part can they both build? In what time will they both build it, if they work together?

68. A. can build a wall in 17 days, and B. can build it in 13 days. What part can each build in 1 day? What part can they both build? In what time will they build it, if they work together?

69. A. and B. can do a piece of work in 6 days, and B. alone can do it in 10 days. What part can they both do in 1 day? What part can B. do in 1 day? What part can A. do in 1 day?

70. A. and B. can do a piece of work in 13 days, and B. can do it alone in 19 days. How much can they both do in 1 day? How much can B.? How much can A.?

71. There is a pole  $\frac{3}{8}$  painted green,  $\frac{1}{4}$  painted white,  $\frac{1}{8}$  painted black, and 2 feet unpainted. What is the length of the pole?

72. There is a pole  $\frac{3}{11}$  painted green,  $\frac{1}{3}$  painted white,  $\frac{1}{5}$  painted black, and 5.5 feet unpainted. What is the length of the pole?

73. A man travels 5 miles an hour, and after he has been gone 2 hours, an express starts in pursuit, and travels 7 miles an hour. How much does the express gain in 1 hour? In how many hours will the man be overtaken?

74. A man travels  $7\frac{1}{2}$  miles an hour, and after he has been gone  $3\frac{1}{2}$  hours, an express starts in pursuit, and travels  $11\frac{1}{2}$  miles an hour. In how many hours will the man be overtaken?

75. If I pay one cent for an apple, twice as much for a lemon, and for an orange twice as much as for a lemon, how much do I pay for the three?

76. If a bushel of beans cost \$1.25, a bushel of potatoes .6 as much, and a bushel of wheat 2.5 as much as the potatoes, how much do they all cost?

77. If we add  $\frac{1}{2}$  a number to itself, we obtain  $\frac{3}{2}$  of the number. If 9 is  $\frac{3}{2}$  of a number, what is  $\frac{1}{2}$ ? What is the number?

78. If  $9\frac{5}{8}$  is  $\frac{15}{8}$  of a number, what is the number?

79. If we add  $\frac{1}{2}$  and  $\frac{1}{3}$  of a number to itself, we obtain  $\frac{11}{6}$  of the number. 22 is  $\frac{11}{6}$  of what number?

80.  $41\frac{5}{8}$  is  $\frac{21}{7}$  of what number?

81. James being asked how many cents he had, said that if he had  $\frac{1}{2}$  as many more and  $\frac{1}{4}$  as many more, he should have 14. How many had he?

82. A man being asked how far he had travelled, said that if he had travelled as far again, and  $\frac{1}{13}$  as far and  $\frac{2}{13}$  as far, he should have gone 119 miles. How far had he travelled?

83. If 3 boys spend 12 cents in 2 weeks, how many boys will spend 30 cents in 3 weeks, at the same rate? How much does 1 boy spend in 2 weeks? In 1 week? In 3 weeks? Then how many boys will spend 30 cents in 3 weeks?

84. If 8 men lay 10 rods of wall in 4 days, how many men will lay 15 rods in 3 days?

85. What number is that,  $\frac{1}{2}$  and  $\frac{1}{3}$  of which and 1 more, are equal to the number itself?

86.  $\frac{2}{3}$  and  $\frac{3}{4}$  of a certain number, are 6 less than the number itself. What is the number?

## CHAPTER X.

## THE RULE OF THREE,—OR PROPORTION.

The RATIO of two numbers, is the quotient of the first by the second. Thus the ratio of 3 to 4, is  $\frac{3}{4}$ ; of 6 to 2,  $\frac{6}{2}$ .

A ratio is usually expressed, by two points written between the numbers; as, 3 : 4; 6 : 2, which are read, 3 is to 4; 6 is to 2.

When two ratios are equal to each other, they may be written together, thus: 2 : 4 = 3 : 6, which is read, 2 is to 4, equals 3 is to 6; or thus: 2 : 4 :: 3 : 6, read, 2 is to 4 as 3 is to 6. Four numbers bearing such a relation to each other, are said to be *proportional*, and the expression is called a PROPORTION.

The first term of every ratio, is called the *antecedent*, and the second, the *consequent*. In every proportion, the antecedents and the consequents may exchange places. Thus, 2 : 6 :: 7 : 21, and 6 : 2 :: 21 : 7, are each true proportions.

The first and fourth terms of a proportion, are called the *extremes*, the second and third terms, the *means*.

The proportion 3 : 12 = 2 : 8 may also be written  $\frac{3}{12} = \frac{2}{8}$ . If these two fractions were reduced to a common denominator, their numerators would be the same. But the numerators would be found, by multiplying each numerator by the other denominator; therefore, one of the numerators would represent the product of the extremes,—the other, the product of the means. Hence in every proportion, *the product of the extremes, is equal to the product of the means*.

Then, when one extreme and the two means are given, to find the other extreme: *Divide the product of the means, by the given extreme.*

## EXAMPLE FOR THE BOARD.

If 7 barrels of flour cost \$35, what will 11 barrels cost?

It is evident that the ratio of 7 barrels to 11 barrels will be the same, as that of the price of 7 barrels to the price of 11 barrels. We have, then, the three terms of a proportion:

$$\begin{matrix} bl. & bl. & \\ 7 & : 11 & :: 35 : \end{matrix} \qquad Ans.$$

Dividing the product of the means, by the given extreme, we find \$55 for the price of 11 barrels. Hence we derive THE RULE OF THREE. *Make that which is of the same kind with the answer, the third term of a proportion. If the answer will be greater, make the greater of the two remaining numbers the second term, and the less, the first term. If less, make the less number the second term, and the greater the first term. Divide the product of the second and third terms, by the first term, and you will obtain the fourth term, which will be the Answer.*

1. If 11 yards of flannel are worth \$2.37, what will be the price of 19 yards?
2. If a cistern discharges 75.09 gallons of water in 1.5 hours, how much will it discharge in 7.93 hours?
3. A man paid \$7.96 for the interest of a certain sum of money, for 2.1 years. How much would he pay for the use of the same sum, 5.09 years?
4. How far would a ship sail in 11.64 hours, at the rate of 78.8 miles in 14.2 hours?
5. What must I pay my gardener for 37.25 days' labour, his wages being \$10.75 per week?
6. If 12 horses eat 11.375 bushels of oats in a week, how many bushels will 74 horses eat in the same time?
7. How many hours will it take a carrier dove to fly 190.77 miles, at the rate of 46.31 miles in 2.95 hours?

8. How many yards of serge, that is  $\frac{1}{4}$  wide, will line a cloak, containing 9.75 yards of broadcloth, that is 1.5 yards wide?
9. The provisions of a garrison are sufficient to supply 736 men 14.5 days. How long will they last 429 men?
10. A family of 7 men use a barrel of flour in 74 days. How many men would use a barrel in 18.5 days?
11. If 49 men can build a wall in 25.8 days, in what time will 65 men build it?
12. How much carpeting, that is  $\frac{1}{2}yd.$  wide, will cover a floor  $5.25yd.$  long and  $4.75yd.$  wide?
13. If the interest of \$1.50 is \$0.0975 for 13mo., what is the interest of \$548.63 for the same time?
14. If I can perform a journey in 8.7 days, by travelling 9 hours each day, in what time can I perform it, by travelling 7.96 hours a day?
15. A bankrupt paid 43 cents for every dollar of his debts. How much would he pay on a debt of \$569.31?
16. A grocer bought 11cwt. 3qr. of sugar, for \$83.21. For how much must he sell 4cwt. 1qr. 22lb., so as neither to gain nor lose?
17. If the price of 16yd. 3qr. of sheeting is \$2.45, what is the price of 4.91yd.?
18. How many men will build a wall in 13.174 days, that 14 men can build in 9.41 days?
19. How many dollars are equivalent to £13 7s. 11d.; \$1.00 being equal to 4s. 6d.?
20. How many men can do a piece of work in 28.75 days, that 39 men can do in 57.5 days?
21. The debts of a bankrupt are \$19946.25, to meet which, he has property, valued at \$7602.375. How much can he pay on a debt of \$693.50?

22. A. and B., traded in company. A.'s money, which was \$9621.75, remained in the firm 11.8mo. How long was B.'s money, which was \$12770.00, in the firm, the gain being divided equally?

23. A. B. & C. invested \$16329.00 in merchandise. They sold their goods so as to gain \$4101.375. How much of the gain ought B. to receive, he having contributed \$7075.15?

24. A tailor made 37 coats, each coat containing 1.87yd. of cloth, 1.5 yards wide. How much silk that is .67 yards wide, will be required to line the whole?

25. When a pole  $4\frac{7}{8}$  ft. high, casts a shadow of 4.25 feet, what is the height of a steeple, that casts a shadow of  $19\frac{1}{2}$  feet?

26. How much sugar can I buy for \$96.25, if I pay \$71.50 for 9cwt. 2qr 27lb.?

27. If  $2\frac{1}{2}$  lb. of indigo cost \$4.625, what will be the cost of  $9\frac{1}{4}$  lb.?

#### EXAMPLE FOR THE BOARD.

If 12 men can build a wall 16 feet long, 2 feet thick, and 4 feet high, in a week, how many men can build a wall 24 feet long, 3 feet thick, and 6 feet high, in the same time?

$$\begin{array}{l} 16 \text{ long, : } 24 \text{ long, } \\ 2 \text{ thick, : } 4 \text{ thick, } \\ 4 \text{ high, : } 6 \text{ high, } \end{array} \left. \right\} \therefore 12 \text{ men, : } - \text{ men.}$$

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$$128 : 576 \qquad \qquad \qquad \therefore 12 \text{ men, : } 54 \text{ men. } \textit{Ans.}$$

This is a question in COMPOUND PROPORTION. The third term is determined in the same way as in Simple Proportion. Of the remaining numbers, we compare any two of a kind, writing one for a first term, and the other for a second, until all are brought down. Then, *the product of the first terms, : the product of the second terms, :: the third term, : the Answer.*

28. If the wages of 24 men for 3.5 days are \$96.50, what will be the wages of 19 men for 7.75 days?

29. If 18 men can build a wall 100 ft. long 2 ft. wide, and 6 ft. high, in a given time, how much wall that is 3 ft. wide and 9 ft. high, can 21 men build in the same time?

30. If 7 men can reap 115.5 acres of wheat in 8.25 days, how many men can reap 276.3 acres in 7.875 days?

31. If the interest of \$281.00 for 1 yr. 5 mo. is \$20.95, what will be the interest of \$500.00 for 3 yr. 11 mo. at the same rate?

32. If 16 horses eat 96 bushels of oats in 2 mo., how many horses will eat 153 bushels in 1 month?

33. If I pay 17 men \$204.00 for 8 days' work, how many men can I hire 19.5 days, for \$380.25?

34. If 46.9 acres will pasture 29 oxen 11 weeks, how many acres will pasture 17 oxen 21.7 weeks?

35. My horse can travel 169 miles in 3 days, when the days are 10 hours long. In how many days of 8.75 hours will he travel 243.7 miles?

36. If I pay \$15.00 for the cartage of 9 tons of coal 35 miles, how much must I pay for carting 13 tons 8 miles?

37. If 18 men will work 7 days for \$133.75, how many days will 13 men work for \$94.00?

38. If 12 sacks of sugar, at 7 cents a pound, cost \$83.61, what must I give for 16 sacks, at 8 cents a pound?

39. How many men will be required to perform a piece of work in 7 days, working 9 hours a day, that 25 men can perform in 12 days, by working 8 hours a day?

40. A vessel has provisions sufficient to furnish 30 men for 6 months, allowing each man 18 ounces a day. How long would the same provisions furnish 45 men, allowing 14 ounces per day?

## REVIEW.

Give an example of a Compound Number. Repeat the tables of Compound Numbers. Give an example in Compound Addition; and tell how the sum may be obtained. Give an example in Compound Subtraction; and tell how you obtain the difference. Give an example in Compound Multiplication; and tell how you obtain the product. Give an example in Compound Division; and tell how you obtain the quotient. How do you obtain the Square Contents of any surface? How do you obtain the Cubical, or Solid Contents of any regular body? What do you understand by Per Centage? What is the Rate per cent? What is Interest? What is the Principal?—the Rate?—the Amount? Knowing the rate for one year, how do we obtain the rate for any given time? Having found the rate for the time, how is the interest found? When the rate is 6 per cent, how is the rate for any given time found? What is the present worth of any sum of money? How is it found? What is the Discount; and how is it found? How are Fractions obtained? Is the Divisor or the Dividend, written for the Numerator? What is a proper Fraction?—an improper Fraction?—a mixed Number?—a Compound Fraction? How may an improper Fraction be reduced to a whole or mixed Number? How may a mixed Number be reduced to an improper Fraction? How may a whole Number be written in the form of an improper Fraction? How may a Compound Fraction be reduced to a simple one? How may a Fraction be reduced to a Decimal? How do you add Fractions? How do you reduce Fractions to a common Denominator? How do you subtract Fractions? What if the fraction in the subtrahend is larger than that in the minuend? How do you multiply Fractions together? What two methods are given for dividing Fractions? How do you reduce Fractions to their lowest terms? How do you reduce Decimals to Fractions? How do you reduce Fractions of a higher denomination to whole Numbers of a lower? How do you reduce whole Numbers of a lower denomination to the Fraction of a higher?

What do you understand by the Ratio of two numbers? What is the ratio of 6 to 11? 16 to 15? 29 to 31? How is a ratio usually expressed? How is it read? How may two equal ratios be written together, and read? What is such an

expression called? What is the first term of every ratio called? The second term? May the position of the antecedents and consequents be changed? What are the extremes of a proportion? The means? How can you show that the product of the extremes is equal to the product of the means? When one extreme and the two means are given, how do you find the other extreme? Propose a sum in Proportion; and work it on the board. How are the numbers arranged in Compound Proportion?

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## MISCELLANEOUS EXAMPLES.

1. A merchant bought flour for \$1650.22, wheat for \$843.77, barley for \$905.17, rye for \$1017.63, and oats for \$741.625. How much did he gain, by selling the whole for \$5331.00?
2. A locomotive travelled at the rate of 14.9 miles per hour, for 2.33 hours, and 16.08 miles per hour for 3.15 hours. What distance did it go in the whole time?
3. A grain dealer has 145 sacks of wheat, containing 2.45 bushels each, 170 sacks containing 3.09 bushels each, and 2181 sacks, containing 3.7 bushels each. He sells 4906.85 bushels; and wishes to divide the remainder equally between 4 bins. How much must he put into each bin?
4. If I purchase 128gal. 2qt. of molasses from each of 9 men, and put the whole in 13 casks, how much must each cask hold?
5. A clerk's salary is \$1025.00 a year, and his expenses \$2.25 a day. How much will he save in 4.63 years?
6. If 259gal. 2qt. of molasses cost \$18.75, what is the price of a pint?
7. An apothecary had 63 bottles of equal size, the whole containing 7Cong. 3O. 15f3. How much did each hold; and how many drops of water would fill the whole?

8. Divide .0000760093 by 100119.7.
9. How many seconds will there have been from the commencement of the Christian era till the close of the year 1844?
10. What number divided by 306800000 will give 496.38?
11. Add  $17\frac{1}{2}$ ,  $\frac{1}{2}$  of  $\frac{2}{3}$  of  $\frac{7}{8}$  of 16,  $39\frac{1}{17}$  and  $\frac{4}{11}$ , and subtract  $2\frac{3}{4}$  from the sum.
12. Reduce  $\frac{1\frac{1}{2}}{3}$  of a furlong to rods, &c., and subtract it from 2 miles.
13. The president, cashier, and teller of a bank, receive together \$4097.00. Of this amount the president receives  $\frac{3}{13}$ , the cashier  $\frac{2}{3}$  of the remainder, and the teller the rest. How much does each receive?
14. A grocer bought 189 gal. 2 qt. of molasses for \$63.50. At what rate must he sell it per gallon, in order to gain 10 per cent.?
15. A. borrowed of B. \$1197.63, for which he gave his note, dated Aug. 1, 1833. How much was due on the note May 21, 1841, computing interest at 6 per cent.?
16. What is the difference between the interest and the discount of \$2009.00 for 4 yr. 6 mo. 24 dy.; interest at 6 per cent.?
17. At what time, between 8 and 9 o'clock, are the hour and minute hands of a watch exactly together?
18. How many bricks, 8 inches long, 4 inches wide, and 2 inches thick, are in a pile  $9\frac{1}{2}$  ft. long,  $4\frac{1}{2}$  feet wide, and  $6\frac{1}{2}$  feet high?
19. How many feet from Boston to Washington, calling the distance 435 m. 7 fur. 38 r.? How long would it take to walk between the two places, taking 2 steps in a second, and 2.55 feet at each step?
20. What number, multiplied by  $5\frac{1}{2}$ , will give  $31\frac{1}{2}$ ?

21. What number, subtracted from  $14\frac{3}{4}$ , will leave  $7\frac{1}{4}$ ?
22. What number, added to  $76\frac{3}{7}$ , will give  $185.512$ ?
23. What number, divided by  $9\frac{1}{2}$ , will give  $5\frac{1}{3}$ ?
24. What number, increased by  $\frac{2}{3}$ ,  $\frac{4}{5}$ , and  $\frac{5}{6}$ , of itself, gives 16?
25. What number, diminished by  $\frac{1}{11}$  and  $\frac{1}{5}$  of itself, gives 16?
26. What number, increased by 27 more than  $\frac{2}{5}$  and  $\frac{2}{3}$  of itself, gives 91?
27. If I take  $2.506cwt.$  of sugar from a cask containing  $4cwt. 3qr.$ , and sell the remainder at 7 cents a pound, how much shall I receive?
28. If I can buy  $4\frac{5}{17}$  tons of hay for \$59.61, how much must I give for  $11\frac{2}{3}$  tons?
29. If  $143\frac{1}{2}$  gallons of water per hour run into a cistern holding  $741\frac{1}{2}$  gallons, and  $21\frac{1}{2}$  gallons run out hourly by one pipe, and  $62\frac{1}{2}$  gallons by another, in what time will the cistern be filled?
30. A man sold  $\frac{2}{3}$  of a farm which contained  $716\frac{1}{4}$  acres, for \$5012.25. How much did he receive per acre?
31. A grocer sold the following articles:  
 3cwt. 17lb. of flour, at \$0.029 per pound.  
 5cwt. 2qr. of sugar, at \$0.0625 per pound.  
 59gal. 3qt. of molasses, at \$0.085 per quart.  
 27lb. 8oz. of tea, at \$0.75 per pound.  
 What was the amount of the bill?
32. Bought 17 hogsheads of sugar, each holding 6cwt. 1qr. 17lb. What did the whole amount to, at  $6\frac{1}{2}$  cents a pound?
33. How many cubic feet are there in a pile of 8764 bricks, each brick being 8in. long, 4in. wide, and 2in. thick?

34. A commission merchant sold 5 bales of cambric, at 11cts. a yard, there being 15 pieces in each bale, and 31.25 yards in each piece. What were his profits on the sale, estimating his commission at 5 per cent.?

35. What was the amount of each of the following notes, on the 3d of April, 1844, computing interest at  $5\frac{1}{2}$  per cent.?

\$263.75 New York, Sept. 15th, 1839.

For value received, I promise to pay John Merchant, or order, two hundred and sixty-three dollars and seventy-five cents, on demand.

JAMES FARMER.

\$490.50 Philadelphia, May 5th, 1841.

For value received, I promise to pay Samuel Factor, or order, four hundred and ninety dollars and fifty cents, on demand, without defalcation.

WILLIAM DRAPER.

36. What is the present worth of \$294.75, due in 4yr. 3mo. 24dy., interest at 6 per cent.?

37. What is the present worth of \$1000.00, due in 6yr. 5mo. 15dy., interest at 7 per cent.?

38. How many bushels of oats will 16 horses eat, in the same time that 11 horses eat  $27\frac{1}{2}$  bushels?

39. How long will it take 7 men to build a wall that 23 men can build in 19.55 days?

40. What is the value of 5 pieces of 10 cent calico, measuring as follows:— $29\frac{1}{2}yd.$ ,  $30yd.$ ,  $28\frac{1}{2}yd.$ ,  $31\frac{1}{2}yd.$ , and  $27\frac{1}{2}yd.$ ?

41. From a piece of broadcloth which originally contained  $27\frac{1}{2}$  yards,  $8\frac{1}{2}$  yards have been sold. At what price per yard must the remainder be sold to bring \$96.62?

42. What is the amount of \$91.70, for 5yr. 7mo. 23dy., at 7 per cent. compound interest?

43. If  $8\frac{7}{9}$  yd. of cloth, that is  $1\frac{2}{3}$  yd. wide, are worth \$54.25, what is the value of  $11\frac{1}{3}$  yd. of the same quality, that is  $1\frac{1}{3}$  yd. wide?

44. If  $3\frac{9}{13}$  barrels of flour cost \$18.50, what is the cost of one barrel?

45. When wheat is \$1.125 per bushel, what must I pay for 15 sacks, each holding  $2\frac{5}{8}$  bushels?

46.  $\frac{4}{5}$  and  $\frac{1}{3}$  and  $\frac{5}{17}$  and  $\frac{2}{7}$  of a certain number, make 69. What is the number?

47. When taxes are rated at  $\frac{1}{10}$  of 1 per cent., what will be the amount of tax paid by a man whose property is valued at \$3891.64?

48. How many tiles that are 8 inches square, will be required to pave a yard that is 129 ft. 4 in. long, and 32 ft. wide?

49.  $76\frac{5}{21}$  is  $\frac{8}{11}$  of  $\frac{2}{3}$  of what number?

50. A teacher pays for the rent of his school-room \$95.00 a year; for assistance \$239.75; for fuel \$18.50; and for other incidental expenses \$76.625. How much can he lay up at the end of the year, supposing him to have 49 scholars, who pay him \$5.75 a quarter—his personal expenses being \$29.29 a month.

51. How many steps shall I take in walking 4.7 miles, if each step measures 2.5 feet? How long will it take me to walk the whole distance, if I take 149 steps in a minute?

52.  $14\frac{1}{2}$  is  $2\frac{1}{3}$  times  $\frac{2}{5}$  of what number?

53. Add  $5\frac{1}{2}$ ,  $7\frac{1}{3}$  and  $8\frac{3}{4}$ ,—subtract  $3\frac{2}{3}$  from the sum,—multiply the remainder by  $9\frac{5}{6}$ , and divide the product by  $17\frac{1}{4}$ .

54. If 12 men can build a wall 40 feet long, 12 feet high, and 4 feet thick, in 27.7 days, in how many days will 8 men build a wall 92 feet long, 8 feet high, and 3 feet thick?

55. How much must I pay for pasturing 37 cows, if the pasture of 17 cows costs \$21.87½?

56. If 999 barrels of cider cost \$1992.00, what will be the cost of 625 barrels?

57. A man being asked his age, said that if  $\frac{1}{2}$  of his age,  $\frac{1}{3}$  of his age, and  $\frac{1}{4}$  of his age, were added to his age, the sum would be 50. How old was he?

58. A cistern has 3 pipes, the first of which would discharge it in 7 hours, the second in 5 hours, and the third in 4.5 hours. If they are all allowed to run at once, in what time will the cistern be emptied?

59. How many drops of water are there in a hogshead, that holds 96.43 gallons?

60. A grocer mixed 20 pounds of tea worth 75 cents a pound; 19.5 pounds, at 63 cents; 25.75 pounds, at 50 cents, and 31.875 pounds, at 80 cents. At what price per pound, ought he to sell the mixture?

61. A man and boy can do a piece of work in 10 days, and the man alone, can do it in 14.97 days. In what time can the boy do it?

62. If 25 yd. 3qr. 3na. of cambric, cost 12s. 4d., what will be the cost of 17yd. 1qr. 2na.?

63. If 36.5 bushels of oats will last 19 horses 2.7 weeks, how long will 44.4 bushels last 11 horses?

64. A draper lost \$7.62 by the sale of a piece of cloth, which was 9 per cent. of the original cost. What did the cloth cost him?

65. How many bricks that are 8 inches long, 4 inches wide, and 2 inches thick, will be required to build a square wall, each side of which measures 18 feet long, 2 feet thick, and 7.5 feet high?

66. A man invests  $\frac{1}{4}$  of his property in bank stock,  $\frac{1}{4}$  in real estate,  $\frac{2}{3}$  in merchandise, and the remainder, which is \$1250.00, in personal property. How much is he worth?

67. Four men traded in partnership. A. contributed \$1925.00, B. contributed \$2075.50, C. contributed \$1800.00, and D. contributed \$1430.00. How ought the gain, which was \$1500.00, to be divided among them?

68. A man exchanged 250 yards of broad-cloth that cost him \$4.75 per yard, for 6.5 acres of land. At what price per acre must he sell the land, in order to gain 15 per cent.?

69. Three men are employed to lay a wall. A. could lay it in 25 days, B. in 31 days, and C. in 19 days. In what time will the wall be finished?

70. What part of £29 19s. 3d. is £7 7s.?

71. A labourer received \$1.25 for every day he worked, and his expenses were 50 cents a day. How much did he save in a year, if he deducted 13 holidays from his working-days?

72. If I mix 19 bushels of oats, worth  $37\frac{1}{2}$  cents a bushel, with 42 bushels of wheat, worth \$1.10 per bushel, what will be the value of 19.25 bushels of the mixture?

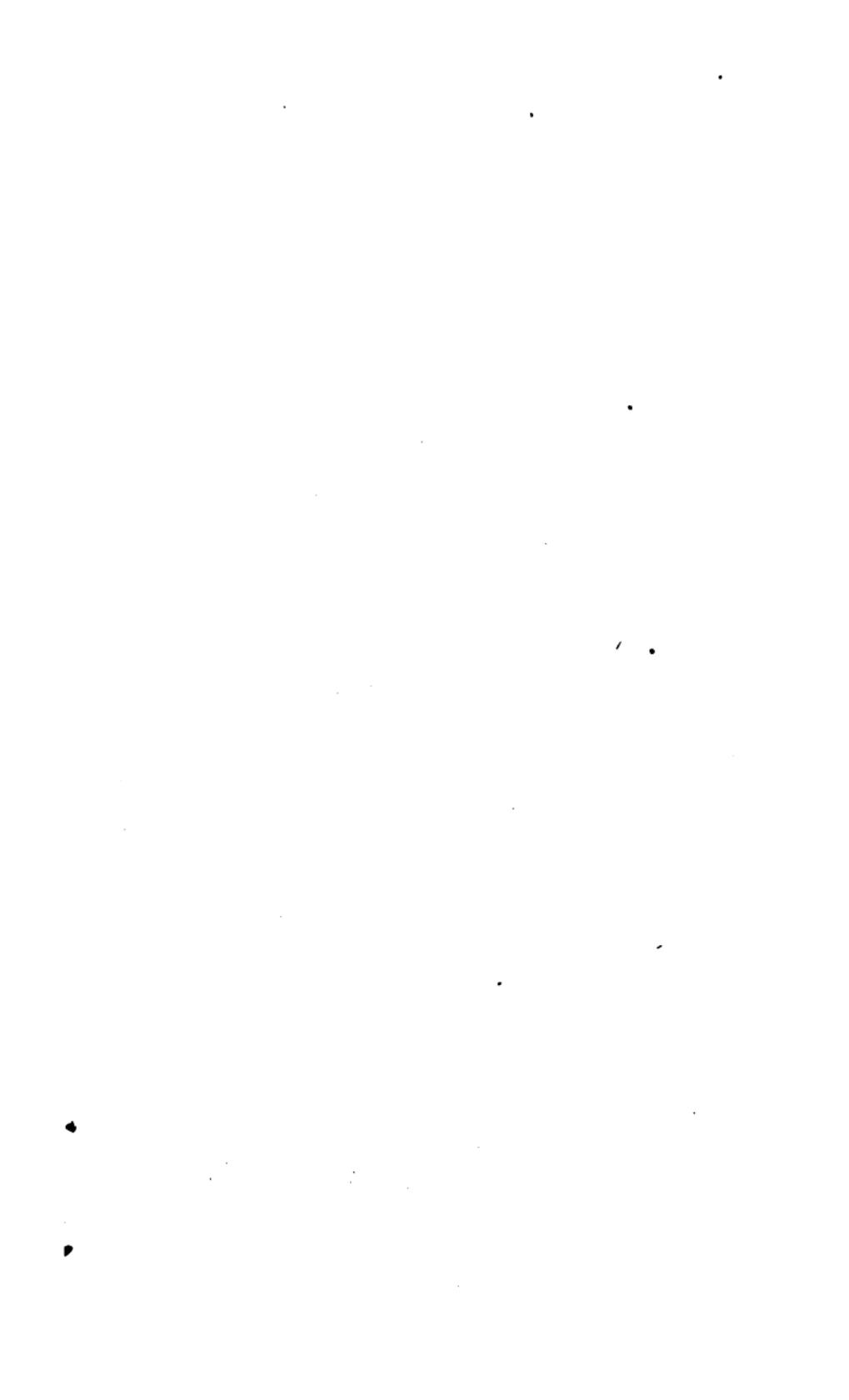
73. What is the value of 9 casks of molasses, each holding 95 gal. 3 qt., at 43 cents per gallon?

74. A farmer has 9A. 3R. 30r. of pasturage, 11A. 2R. of mowing, 19A. of grain, and 27A. 1R. 10r. of woodland. What will he receive for the whole farm, at \$35.00 per acre?

75. A. lent B. 187.50 for 5.5 months. How much ought B. to lend A. in return, for 3.9 months?

76. A thief travels  $6\frac{1}{4}$  miles an hour, and after he has been gone  $4\frac{1}{2}$  hours, a constable starts in pursuit, travelling  $7\frac{1}{2}$  miles an hour. In what time will the thief be overtaken?











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